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THE STATUS OF THE ATLANTIC SALMON STOCK OF LAPOILE RIVER, NEWFOUNDLAND, 1993

by

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ABSTRACT

The commercial salmon fishery in SFA 12 was closed in 1984. This closure would have benefitted the LaPoile River salmon stock prior to the commercial moratorium in 1992. Recreational catches retained on the LaPoile River in 1992 and 1993 would have been affected by the SFA 12 zonal quota but if released catches represent retained fish in previous years, then the total catch of small salmon in 1992 was the highest recorded and the catch in 1993 was the fourth highest suggesting a positive impact of the commercial moratorium on returns to the river. However, the potential egg depositions were only 23% of the target egg deposition requirement in both years. This was similar to estimates of egg deposition in 1987-1991 based on retained catches of small salmon, suggesting a higher angling exploitation in 1992 and 1993. The LaPoile River is characterized by a relatively high drainage basin relief, high plateau areas and low vegetation. The accessible portion of the system is comprised of only 519 ha of standing water and the system is subject to extreme fluctuations in water discharge after heavy rainfall. These conditions may affect the quality of the accessible salmon rearing habitat and result in a reduction of salmon production potential. It is recommended that angling exploitation on the river be maintained at or below the 1992-1993 level until the stock has improved relative to the current target or until the target can be refined based on investigations of available habitat.

RÉSUMÉ

La pêche commerciale du saumon dans la ZPS 12 a été fermée en 1984, fermeture qui a dû profiter aux stocks de saumon de la rivière LaPoile avant même le moratoire sur la pêche commerciale de 1992. Les prises sportives gardées provenant de cette rivière en 1992 et 1993 ont logiquement été touchées par le quota adopté dans la zone 12; pourtant, si les saumons remis à l'eau sont représentatifs des prises qui étaient gardées les années précédentes, les captures totales de petits saumons en 1992 étaient les plus hautes jamais enregistrées, et les prises de 1993 venaient au quatrième rang. Ces résultats révèlent que le moratoire a eu un effet favorable sur les montaisons. Toutefois, durant les deux années considérée, la ponte potentielle n'a été que de 23 % de la cible. Elle était comparable aux estimations de ponte des années 1987-1991 fondées sur les prises de petit saumon gardées, ce qui permettrait de conclure à un taux d'exploitation plus élevé par les pêcheurs à la ligne en 1992 et 1993. La rivière LaPoile se caractérise par un relief de son bassin de drainage relativement élevé, des hauts plateaux et une végétation basse. La partie accessible du réseau hydrographique se compose de seulement 519 ha d'eaux dormantes et le réseau est exposé à des fluctuations extrêmes de l'écoulement après de fortes pluies. Ces conditions peuvent influer sur la qualité des zones d'élevage accessibles au saumon, occasionnant une diminution du potentiel productif de ce poisson. On recommande que le taux d'exploitation du saumon de la rivière par les pêcheurs à la ligne soit maintenu au niveau de 1992-1993 ou à un niveau inférieur jusqu'à ce que le stock se soit rapproché de la cible actuelle ou jusqu'à ce que la cible soit révisée, après étude de l'habitat disponible.

INTRODUCTION

The LaPoile River is the largest of nine scheduled Atlantic salmon rivers in Salmon Fishing Area (SFA) 12 (Figure 1) and comprises 33% of the total drainage area. It flows into the bottom of LaPoile Bay at latitude 47° 48' 00'' N. and longitude 58° 19' 20'' W on the southwest coast of the island of Newfoundland. The only other river, flowing into this bay is East Bay Brook at latitude 47° 46' 03'' N. and 58° 15' 05'' W. The LaPoile River has a total axial length of 39.9 km and drains a high plateau area which has a maximum basin relief of 624.8 m. The river has a drainage area of 588.4 km^2 (Porter et al., 1974).

The LaPoile River has supported a recreational fishery for Atlantic salmon (*Salmo salar* L.) at least since 1953 when angling catch statistics were first recorded (Mullins et al., 1989) and guiding and outfitting operations for salmon and sea-run brook trout (*Salvelinus fontinalis* L.) since 1967. Atlantic salmon were exploited commercially in SFA 12 until 1984 when the fishery was closed to reduce the interception of Maritime provinces and Quebec origin salmon (Pippy, 1982). In 1990 and 1991, to help rebuild declining Newfoundland stocks, the commercial salmon fisheries in all other Salmon Fishing Areas of insular Newfoundland and Labrador were restricted by quotas. This was followed in 1992, by complete closure of the commercial salmon fishery in insular Newfoundland for a period of five years and recreational fishery quotas were introduced in each SFA to control river harvests. A summary of commercial and recreational fishery seasons and quotas which would have affected recreational catches on the LaPoile River since 1974 are given in Table 1.

The 1984-1991 mean recreational catch on the LaPoile River, following the closure of the SFA 12 commercial salmon fishery, was 216 small salmon (Table 2) which was approximately 57% higher than the mean in the previous six years (1978-1983). However, mean angling effort increased by 102% over the same period (Figure 2) and resulted in a 7% decrease in the mean catch-per-unit-effort (CPUE) (Table 2).

The recreational salmon quotas introduced in 1992 were unpopular with anglers and outfitters in all SFAs. Camp operators claimed that their business suffered when clients were unwilling to make bookings and many anglers argued that high catches on a few rivers would result in the closure of the fishery for a whole area. Some operators also took action to evaluate the effects of the 1992 salmon management plan on salmon abundance in their rivers. This documents presents the status of the salmon stock on the LaPoile River in 1993 in relation to estimates of historical levels and evaluation of the effects of reductions in fishing effort. This assessment was undertaken by the principal outfitter on the river, in cooperation with the Department of Fisheries and Oceans (DFO).

MATERIALS AND METHODS

Recreational Fishery

Weekly salmon angling statistics for the LaPoile River and SFA 12 have been compiled by Department of Fisheries and Oceans (DFO) river guardians since 1953 and include the catch and release fishery which was permitted after the SFA 12 zonal quotas were reached in 1992 and 1993. Data recorded on a daily basis included water level; observed and estimated rod days of effort; observed and estimated catches of small salmon (retained and released) and observed and estimated catches of large salmon. Large salmon were required to be released since 1984. One rod day is the fishing effort expended by one angler during all or part of one day; two or more fishing periods by the same angler on the same day are counted as one rod day. The observed data represent actual observations by the river guardians and fisheries officers. Estimated data represent effort and catches for days when the river was not patrolled or while patrolling other areas. These estimates were based on knowledge of the migratory pattern of the salmon stock, local weather conditions, water levels, and patterns of local angling effort and information gathered through conversations with anglers and outfitters.

Recreational salmon catches were categorized into small and large size groups. The criteria for small and large salmon were as follows:

Small	-	< 63 cm fork length
Large	-	> = 63 cm fork length

In 1993, recreational catch and effort statistics on the LaPoile River were reported separately for above and below the counting fence location. Angling catch and effort for LaPoile River and SFA 12 prior to 1993 were obtained from summary reports published by DFO.

Estimation of Angling Exploitation Rate

A fish counting fence was installed and operated on the LaPoile River from June 16 to July 30, 1993. The design of the facility was similar to that of Anderson and MacDonald (1974), with the exception that the wood-frame counting trap was replaced with a steel frame design. The steel-frame trap provided increased attraction flow for salmon at the entrance in order to minimize any potential delay to migration caused by the fence. The counting trap was placed in the main flow of the river, approximately 2.4 km upstream from the mouth. A barrier fence (without a trap) was also installed on an adjacent branch of the river to prevent fish from bypassing the counting trap (Figure 3).

The counting fence was inoperative for a two day period on July 22-23 due to a washout. The number of small and large salmon passing through the fence on these two days was estimated by taking the average of the total number observed 2 days before and 2 days after the washout. The total fence count was adjusted based on these estimated values. The accuracy of this method was tested by predicting the daily counts over the entire run and making comparisons to the numbers of salmon actually observed.

The angling exploitation rate (ER) on the LaPoile River in 1993 was calculated from the adjusted counts of small salmon at the counting fence and the angling catches above and below the fence according to the formula:

$$ER = \frac{\textit{(total \# small salmon retained by anglers above and below the counting fence during operation)}}{\textit{(\# small salmon counted at fence) + (total \# small salmon retained below the fence during operation)}}$$

Because released fish may have been caught more than once they were not used in the calculation of exploitation rate.

Run timing of Atlantic salmon to the LaPoile River

The run timing of Atlantic salmon into the LaPoile River and other SFA 12 rivers in 1993 and 1987-1991 was estimated based on the timing of catches of small salmon in the recreational fishery. Run timing was estimated as the standardized week (Table 3) in which the accumulated daily angling catch (retained + released) of small salmon equalled 50% of the total catch at the end of the season. The run timing to LaPoile River in 1993 was compared the run timing to the river in 1987-1991 and to other SFA 12 rivers in 1993 and 1987-1991.

Returns of Atlantic salmon to the LaPoile River

The total returns to the river were determined based on the number of fish through the counting fence, those removed by anglers and estimated returns after the counting fence was removed. The returns of small salmon to the LaPoile River after the counting fence operation were estimated by dividing the catch of small salmon retained after July 31 by the angling exploitation rate. The returns of large salmon after fence removal were determined by multiplying the estimated small salmon returns by the ratio of large to small salmon observed at the counting fence.

Biological Characteristics of LaPoile River Atlantic salmon

Biological characteristics of LaPoile River salmon stock were obtained from sampling conducted in the recreational fishery and at the counting fence. Salmon retained by anglers were sampled for fork length to the nearest 0.1 cm, and gutted weight to the nearest 0.1 kg, and sex determination by internal examination. Scale samples were obtained for age determination from the left side of the fish in an area above the lateral line and on a line from the posterior edge of the dorsal fin to the anterior edge of the anal fin. Approximately 10-15 scales were collected. The river age, sea age and evidence of previous spawning were determined according to the method described by Anonymous (1984). Sampling at the counting fence included fork length measurements only.

Estimation of Potential Egg Depositions

The potential egg depositions were calculated using the total spawning escapement, observed biological characteristics (mean whole weight of females, percent female) and a mean fecundity of 1540 eggs/kg of body weight (Porter and Chadwick, 1983). The gutted weight of female salmon was converted to whole weight by multiplying by a factor of 1.136 derived for the Humber River, 1991-1993 (Appendix 1). The spawning escapement was obtained by subtracting the total recreational catch of small salmon retained from the total estimated returns to the river.

Estimation of Target Egg Deposition Requirements

The egg deposition requirement for conservation of Atlantic salmon stocks on the LaPoile River was calculated using a target egg deposition rate of 2.4 eggs/m^2 of fluvial parr rearing area (Elson, 1957) and 368 eggs/ha of lacustrine area (O'Connell, 1991). The classical fluvial parr rearing habitat (Elson, 1957) for the LaPoile River has been estimated at 2.1457 x 10^6 m^2 (DFO archive files). The total available lacustrine area (hectares) was measured using 1:50,000 scale topographic maps and a dot grid. Obstructions limiting accessibility of salmon to fluvial and lacustrine rearing areas which were previously identified by Porter et al. (1974) were verified by a helicopter survey in 1993.

A stream survey, to verify previously reported estimates of fluvial parr rearing habitat available on the LaPoile River (DFO, archive files), was also begun in 1993 but was not completed. The stream survey followed the methodology outlined by Scruton et al. (1992) (Appendix 2). The preliminary results are given in Appendices 3-5.

Hydrology of the LaPoile River

Hydrological data was not available for the LaPoile River but was obtained from Environment Canada, Water Survey of Canada for two adjacent rivers, Isle aux Morts River and Grandy Brook. Isle aux Morts River is located west of LaPoile Bay at 47° 35 50" N. 59° 00 25" W. and Grandy Brook is located east of LaPoile Bay at 47° 41 00" N. 57° 41 20" W (Figure 1). Isle aux Morts River has a drainage area of 263.7 km^2 and Grandy Brook has a drainage area of 214.2 km^2 (Porter et al. 1974).

Water level in centimetres was measured at the counting fence during each trap check. The trap was checked two times per day.

RESULTS

Recreational Fishery

The 1993 SFA 12 (zonal) recreational quota of 700 small salmon, was split into two parts: 665 fish for June 5 to July 31; and 35 fish for August 1 to September 6. The first part of the quota was reached on July 25 and the second part was reached on August 9. The fishery was closed to catch and release angling only, after each quota was reached. The catch of small and large salmon and angling effort in 1993 peaked in late June and were declining at the time the first part of the season quota was reached (Figure 4). In 1992, the quota of 600 small salmon was reached on July 6 and the fishery was closed to catch and release angling only on all SFA 12 rivers.

Recreational catches actually observed by the river guardian on the LaPoile River in 1993 and 1992 accounted for 98.5% and 97.6%, respectively, of the total retained and released catches of small and large salmon reported.

The total (retained + released) catch of small salmon on the LaPoile River in 1993 was 43% below the total in 1992 but 20% above the 1984-1991 mean (Table 2). The total in 1992 was 109% above the 1984-1991 mean (Table 2). Released catches after the zonal quota was reached comprised 57% of the total (retained + released) catch of small salmon in 1992 and 20% of the total (retained + released) catch in 1993.

The LaPoile River produced about 24% of the catch of small salmon and 51% of the catch of large salmon hooked and released in SFA 12 in 1984-1991 (Table 2). The percentage of SFA 12 small and large catches produced by the LaPoile River in 1993, were about 20% higher than the 1984-1991 mean prior to the commercial moratorium.

The clients of outfitters have traditionally expended about 42% of the angling effort and caught 73% of the total catch of small salmon on the LaPoile River (Table 4). In 1992 and 1993, outfitter clients expended, on average, 34% of the effort and 53% of the total (retained + released) catch of small salmon.

The recreational catches of small salmon on the LaPoile River in 1993 were taken between weeks 24 and 33 (Figure 5a) similar to other SFA 12 rivers in 1993 (Figure 5b) and similar to the 1987-1991 mean (Figure 5c). The run timing of small salmon to the LaPoile River (50% of the total recreational catch taken) in 1993 was week 28, the same as for SFA 12 as a whole (Figure 5a-b). This was one week later than the run timing based on the 1988-1991 mean recreational catches for the LaPoile River and SFA 12 (Figure 5c-d).

Estimation of Angling Exploitation Rate

The counting fence was operated on LaPoile River from June 16 to July 30, 1993. It was inoperative on July 22-23 and July 31 due to washouts after heavy rainfall. The fence was not reinstalled after the July 31 washout because of extensive damage. The peak counts of small salmon occurred on July 8 and July 18 and peak counts of large salmon occurred on June 24 and July 9 (Figure 6) indicating that the majority of the run had already moved upstream prior to July 22. In addition to salmon actually counted at the fence, 14 small and 2 large salmon were estimated to have passed through the fence during the washout on July 22-23. Therefore, the total count at the fence was 507 small and 82 large salmon (Table 5).

A test of the method used to estimate the number of salmon through the fence during washouts revealed that the predicted daily counts over the entire run were similar to those actually observed (Figure 7). The major differences were on days of peak counts at the fence which usually occurred after water levels began to drop following a heavy rainfall (Figure 8). This was probably because of the time required for fish to swim the 2.4 km distance from the mouth of the river to the fence. The washout on July 22 would not have affected the peak count because the fence was reinstalled before the water had returned to normal.

Anglers retained 194 small salmon during the counting fence operation which was 31.96% of the returns during that period (Table 6). This exploitation rate is about 40% higher than the rate determined for the Humber River in 1993 (Mullins and Chaput, in prep.), however, the size of the LaPoile River is much smaller than the Humber River which would result in a higher concentration of effort.

Returns and Spawning Escapements to the LaPoile River

After the counting fence was removed on July 31, 16 small salmon (11 retained) were retained and released by anglers. The mean catch for the same period in 1984-1992 was 17 small. The proportion of the catch taken after July 31 in 1993 was 0.061 compared to 0.071 in 1984-1992, indicating that the catch after fence operations in 1993 was typical of previous years, in spite of the zonal quota being reached on August 9. On the basis of the derived exploitation rate and the number of small salmon retained after July 31, an additional 34 small salmon entered the river after the fence was removed (Table 7). Based on the ratio of large to small salmon at the counting fence, an additional 6 large salmon also entered the river after the fence was removed.

The potential spawning escapement after angling on the LaPoile River in 1993 was 436 small and 88 large salmon (Table 7).

Biological Characteristics

The mean gutted weight of small salmon angled on the LaPoile River was 1.6 kg (N=55); the mean fork length was 54.0 cm (N=53); and 75.8% (50/66) were female (Table 8). The freshwater-age of angled ranged from 2 to 4 years, with a mean of 3.19 (N=63) in freshwater before migrating out to sea for the first time; 61.7% had a freshwater-age of three years (Table 8). Approximately 5% (3/72) had spawned in the previous year. The mean whole weight of angled female small salmon was estimated at 1.77 kg.

Small and large salmon sampled at the counting fence had an average fork length of 54.0 cm (N=45) and 70.2 cm (N=50), respectively (Table 8). The sex composition (external examination) of small salmon was similar to that recorded in the recreational fishery and large salmon at the counting fence were 68.0% (34/50) female (Table 8). Scale samples were not collected from large salmon at the counting fence, therefore, it could not be determined whether or not these were virgin multi-sea-winter spawners or repeat spawning grilse.

Estimation of Potential Egg Depositions

The estimated potential egg deposition by small and large salmon on the LaPoile River in 1993 was approximately 2.0 million eggs or 23% of the minimum required for conservation (Table 9). This value is about 7% below the five year mean immediately prior to the commercial moratorium (Figure 8).

Retrospective analysis of estimated returns based on retained catches only of small salmon and released catches of large salmon, indicated that the potential egg depositions in 1992 were also about 23% of the target and 41% below the highest previous level in 1982 (Table 10). On the basis of both retained and released catches of small salmon (ER=0.3942 based on 1993 total returns and retained + released catches), the potential egg deposition in 1992 would have been about 50% of the target, which is 96% higher than the 1987-1991 mean of 25%, immediately prior to the moratorium. However, because of the possibility of multiple captures of the same fish, released catches cannot be assumed to represent an actual number of individual fish in the river and must be used with caution. It is likely that the percent of target actually achieved in 1992 was between the two estimated values.

On the basis of the mean freshwater-age of three years and a sea-age of one year for small salmon, the majority of returns to the LaPoile River in 1992 and 1993 were the progeny of spawners five years earlier. The estimated percentage of the target egg deposition achieved by spawners in 1987 and 1988 was 30% and 24%, respectively (Table 10). The estimated potential egg deposition in 1989 was 18% of the target (Table 10). Spawners in 1989 would have produced the majority of adults which will return to the river in 1994.

Hydrology of the LaPoile River

Hydrographs of Isle aux Morts River and Grandy Brook, both of which are adjacent to the LaPoile River, indicate that the daily water flow in 1993 ranged from a low of 1 m^3/s to a high of 100 m^3/s following the periods of heavy rainfall which washed out the counting fence on LaPoile River (Figure 8). Both Isle aux Morts River and Grandy Brook showed extreme fluctuations in water flow which increased by a factor of 100 in a 24 hour period following a heavy rainfall. The run-off on these rivers also occurred within a relatively short period of time after the peak discharge was reached (Figure 9). The mean daily water flow on Isle aux Morts River in 1963-1992 and on Grandy Brook in 1982-1992 indicates that these rivers are continuously subjected to high variability in water flow (Figure 10).

From June 1 to September 30, 1993 which included the period of counting fence operation on the LaPoile River, the mean water flow on Isle aux Morts River was about 3% above the 1963-1992 mean and 29%

below the maximum for this period recorded in 1977 (Figure 11a). The mean flow on Grandy Brook for this period was 50% below the maximum which was recorded in 1984 (Figure 11b). For both Isle aux Morts River and Grandy Brook, the summer water flow from June to September was less than many historical levels.

DISCUSSION

The total recreational catch of small and large salmon retained and released on the LaPoile River in 1992 was the highest on record, suggesting that the commercial salmon fishery outside of SFA 12 had intercepted LaPoile River salmon. In 1993, although the retention season for salmon was longer than in 1992, the total recreational catch was less, indicating lower returns to the river in 1993.

The timing of recreational catches of salmon on the LaPoile River in 1993, compared to catches on other SFA 12 rivers, indicates that the run timing of salmon into the river was not altered by the presence of the counting facility. The week in which fifty percent of the total recreational catch was reached in 1993, was week 28 which was the same as for all other SFA 12 rivers. This was one week later than the 1987-1991 mean, but this was true for catches on all SFA 12 rivers in 1993 when compared to the 1987-1991 mean. These results indicate that the run timing and upstream migration of salmon on the LaPoile River in 1993 was no different than on other SFA 12 rivers which did not have a counting fence installation. Hence, the lower angling catches in 1993 compared to 1992 were probably more related to lower salmon abundance than a change in angling exploitation because of the counting fence.

Returns of salmon to the LaPoile River in 1993, on the basis of the number of salmon enumerated at the counting fence, were below the mean of estimated returns in the five years (1987-1991) immediately prior to the commercial moratorium. In 1993, the potential spawning escapement after angling would have achieved only 23% of the target egg deposition requirement which is 11% below the previous five year mean. Had the recreational fishery been closed completely in 1993, the additional spawners obtained would have resulted in only 31% of the target being achieved.

The analysis of estimated potential egg depositions on the LaPoile River in 1974-1991 indicates that the status of the salmon stock improved after the closure of the SFA 12 commercial fishery in 1984. The mean percent of target spawning requirements achieved in 1984-1991 was nearly 100% above the 1974-1983 mean (Table 10). However, in 1992 and 1993 following the commercial moratorium, with the possible exception of 1992, there did not appear to be any additional improvement in the stock. The target spawning requirement was not reached in either 1992 or 1993.

The closure of the commercial salmon fishery in other SFAs in 1992 would have had an effect on stock abundance in SFA 12 and on the LaPoile River. However, it is expected that the greatest potential benefit to these stocks would have already been achieved with the closure of the SFA 12 fishery in 1984. This is because the upstream migration of adult salmon in SFA 12 rivers begins in early June which coincides with the opening date of the 1984-1991 commercial seasons (June 5). Salmon entering SFA 12 rivers in early June would have already escaped interception in commercial fisheries in other SFAs.

The estimates presented of total returns and egg depositions for 1974-1992 were calculated from angling catches using the exploitation rate derived for 1993 on the basis of the assumption that the rate was the same for each year. However, annual variation in actual exploitation rates would have affected these estimates.

The method used to calculate the target egg deposition requirement for the LaPoile River has a number of limitations which are difficult to quantify. These include the effect of habitat preference of juvenile salmon;

the atresia of eggs in the ovary; the dispersal of juveniles from the spawning grounds; and the interaction of anadromous and landlocked forms. These limitations are discussed in detail in O'Connell and Dempson (1991). However, the method is accepted as a reasonable standard for the evaluation of stock status.

Possibly, the greatest influence on the survival of juvenile Atlantic salmon on the LaPoile River observed in 1993, was the extreme fluctuation in water flow. The steep cliffs of the drainage basin and the low vegetation of the surrounding plateaus, resulted in very high flushing rate after a heavy rainfall. This was illustrated by the hydrological data records for two adjacent watersheds. These adjacent rivers which drain similar geological formations and have similar basin relief to the LaPoile River (Porter et al., 1984), exhibited extreme fluctuations in summer run-off during periods of heavy rainfall. The headwater lakes on the LaPoile River were found to be inaccessible to salmon and do not act to dampen high flows. These extreme conditions may also affect the quality of the available rearing habitat and lower the potential productivity of the system. The current egg deposition requirement which is based on 240 eggs/100 sq. m, may, therefore, be too high for the LaPoile River because of limits imposed by the physical characteristics of the drainage basin. It is recommended that potential habitat limitations and habitat use by juvenile salmon be investigated in order to refine the conservation target for this river. This could be done by an intensive survey to identify areas of low juvenile density relative to physical stream characteristics and annual egg deposition rates. It would be necessary to conduct the survey for at least five years to develop a time series. The survey would require at least six man-months in July and August each year at an estimated cost of $30,000.00 per year for field work, in addition to the cost of operating of the counting fence. If a river specific quota is to be developed for the LaPoile River, the stream survey started in 1993 also needs to be completed.

LaPoile River salmon spend an average of three years in freshwater before migrating out to sea for the first time and spend one year at sea before returning to the river to spawn. Therefore, the majority of small salmon, which comprised 83% of the spawning escapement in 1993, were the progeny of salmon that had spawned five years earlier. Hence, the abundance of small salmon on the LaPoile River in 1993 would have been affected by the spawning escapement in 1988, and returns to the river in 1994 will be affected by the spawning escapement in 1989. The estimated number of small salmon spawners in 1989 was about 25% below the number estimated for 1988 (Figure 12). Therefore, if the survival rate of the 1989 year-class, both in the river and at sea, is similar to that of the 1988 year-class, returns in 1994 are anticipated to be below those in 1993 (Figure 12).

Salmon production in the LaPoile River from spawners in 1992 and 1993 (returns in 1997 and 1998) will be the first since the commercial moratorium. The progeny from these spawners will return to the river as adult salmon in 1997 and 1998, respectively. Assuming that these returns will be at least equivalent to the number of spawners, they are anticipated to be among the highest recorded on the river since 1984 (Figure 12).

In order to ensure that the status of the LaPoile River salmon stock continues to improve past the years 1997 and 1998, especially if the commercial moratorium is lifted, it will be important to maintain the recreational fishing mortality on the river at or below the current level. Although the stock is presently at a low level, it appears to have remained relatively stable in 1984-1991 while supporting a fishing mortality which was similar to the 1992 and 1993 levels. Fishing mortality can be controlled through river specific management and refined as more information on this stock is acquired.

Salmon stocks in SFA 12 should continue to be monitored in order to evaluate the full effects of the commercial moratorium on anticipated future returns. Given the trend of increasing angling effort in this area, a counting fence operation in this area would provide valuable information on stock abundance in relation to fishing pressure.

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Table 1. Commercial and recreational fishery quotas and seasons affecting catches of Atlantic salmon on the LaPoile River, 1974–1993.

Management Plan Years	Quota (Number of Fish)	Season (Standardized Weeks)
Commercial Fishery		
1974–1977		20–52
1978–1983		20–28
1984–to–date		SFA 12 Closed
1990–1991		Quotas in all SFA's
1992–1993		Commercial moratorium
Recreational Fishery		
1974–1977		21–37
1978–1983		25–35
1984–1989		24–36
1990		24–36
1991		23–35
1992	600 small	23–27*
1993	665 small	23–30**
1993	35 small	31–32***

Note1. Anglers required to release all large salmon, 1984–1993.
Note2. Recreational season bag limit of 15 fish, 1986–1990.
Note3. Recreational season bag limit of 10 fish, 1991
Note4. Recreational season bag limit of 8 fish, 1992–1993.
Note5. Recreational daily catch limit of 1 fish, 1993.

*The quota was reached in week 27 (July 6) and fishing was closed to catch and release only until week 36.
**The quota of 665 was reached in week 30 (July 25) and season open for catch and release until week 31 (July 31).
***The quota of 35 was reached in week 32 (August 9) and season open for catch and release until week 36 (September 6).

Table 2. Recreational catches (retained and released) of Atlantic salmon, angling effort, percent of SFA 12, and catch-per-unit-effort (CPUE), 1953-1993.

Year	Effort		Small Salmon			Large Salmon			Total	
	Rod-days	% SFA	Ret.	Rel.	% SFA	Ret.	Rel.	% SFA	Catch	CPUE
1953	41	8.6	23	.	9.7	10	.	14.7	33	0.80
1954	56	14.7	7	.	4.3	5	.	13.9	12	0.21
1955	12	8.3	14	.	10.0	2	.	18.2	16	1.33
1956	22	3.1	15	.	5.5	2	.	11.8	17	0.77
1957	24	2.9	33	.	6.0	2	.	11.1	35	1.46
1958	60	3.7	87	.	22.0	6	.	26.1	93	1.55
1959	41	4.6	44	.	10.3	9	.	10.3	53	1.29
1960	44	2.9	37	.	5.6	7	.	50.0	44	1.00
1961	33	2.6	28	.	5.4	7	.	6.9	35	1.06
1962	64	4.4	43	.	4.8	9	.	13.4	52	0.81
1963	130	5.9	84	.	8.2	9	.	15.0	93	0.72
1964	106	6.1	85	.	9.2	7	.	9.6	92	0.87
1965	122	5.6	63	.	5.6	21	.	21.0	84	0.69
1966	61	4.1	84	.	9.9	8	.	12.3	92	1.51
1967	95	5.0	46	.	8.3	10	.	15.4	56	0.59
1968	195	8.6	76	.	10.1	12	.	16.0	88	0.45
1969	136	6.9	88	.	9.5	13	.	14.6	101	0.74
1970	164	12.9	124	.	16.6	8	.	10.1	132	0.80
1971	127	9.0	34	.	7.5	0	.	0.0	34	0.27
1972	78	5.3	91	.	9.8	0	.	0.0	91	1.17
1973	131	8.4	84	.	13.0	4	.	16.0	88	0.67
1974	112	7.9	73	.	11.1	2	.	15.4	75	0.67
1975	153	12.7	55	.	10.8	3	.	15.0	58	0.38
1976	142	15.3	34	.	11.4	2	.	40.0	36	0.25
1977	183	14.8	126	.	22.6	3	.	6.3	129	0.70
1978	220	16.9	32	.	8.7	2	.	10.0	34	0.15
1979	279	16.3	97	.	13.2	3	.	30.0	100	0.36
1980	262	12.0	148	.	18.0	3	.	10.3	151	0.58
1981	350	17.2	184	.	17.4	1	.	5.9	185	0.53
1982	401	14.3	325	.	20.9	2	.	13.3	327	0.82
1983	309	11.7	41	.	6.1	2	.	25.0	43	0.14
1984	397	11.1	274	.	14.3	0	.	0.0	274	0.69
1985	542	14.6	126	.	11.5	.	19	63.3	145	0.27
1986	523	15.2	238	.	25.4	.	24	72.7	262	0.50
1987	453	20.5	255	.	30.8	.	18	66.7	273	0.60
1988	710	19.7	204	.	14.4	.	7	30.4	211	0.30
1989	654	24.6	153	.	27.3	.	6	60.0	159	0.24
1990	735	24.0	219	.	25.6	.	19	63.3	238	0.32
1991	895	32.4	262	.	40.7	.	8	53.3	270	0.30
1992	712	25.2	194	258	30.4	.	40	51.3	492	0.33
1993	939	28.6	206	55	27.7	.	14	63.6	273	0.23
MEANS, 95% CONFIDENCE LIMITS AND N'S PRECEDING 1992:										
Mean (78-83)	304	14.7	138	.	14.1	2	.	15.8	140	0.43
95% CL=+/-	73	2.8	124	.	6.5	1	.	10.8	123	0.30
N	5	5	5	.	5	5	.	5	5	5
Mean (84-91)	614	20.3	216	.	23.7	.	13	51.2	229	0.40
95% CL=+/-	86	3.5	28	.	5.1	.	4	12.7	27	0.09
N	8	8	8	.	8	.	8	8	8	8

Table 3. Standardized weeks used for analysis of the run timing of Atlantic salmon the the LaPoile River and other rivers in SFA 12, 1987–1991 and 1993.

Week	Time Period
20	May 4 to 20
21	May 21 to 27
22	May 28 to June 3
23	June 4 to 10
24	June 11 to 17
25	June 18 to 24
26	June 25 to July 1
27	July 2 to 8
28	July 9 to 15
29	July 16 to 22
30	July 23 to 29
31	July 30 to August 5
32	August 6 to 12
33	August 13 to 19
34	August 20 to 26
35	August 27 to Sept. 2
36	Sept. 3 to 9
37	Sept. 10 to 16
38	Sept. 17 to 23
39	Sept. 24 to 30
40	Oct. 1 to 7

Table 4. Total recreational and outfitter client catches (retained and released) and effort for small Atlantic salmon on the LaPoile River, 1985–1993.

Year	Effort (rod days) Total	Outfitters	% of Total Effort by Outfitters	Catch of small salmon Total	Outfitters	% of Total Catch by Outfitters
1985	542	264	48.7	126	101	80.2
1986	523	264	50.5	238	186	78.2
1987	453	252	55.6	255	185	72.5
1988	710	288	40.6	204	134	65.7
1989	654	252	38.5	153	109	71.2
1990	735	252	34.3	219	160	73.1
1991	895	252	28.2	262	149	56.9
1992	712	294	41.3	452	274	60.6
1993	939	252	26.8	261	119	45.6
Mean (85–91)	645	261	42.3	208	146	71.1
Min	453	252	28.2	126	101	56.9
Max	895	288	55.6	262	186	80.2

Note: Outfitter data supplied by Salmon Hole Lodge.

Table 5. Daily counts of Atlantic salmon and brook trout and mean daily water level, water and air temperatures recorded at the counting fence on the Lapoile River, 1993.

Date	Atlantic salmon Small (<63cm)	Atlantic salmon Large (>=63cm)	Brook Trout	Mean Water Level (cm)	Water temp. (C) Mean	Water temp. (C) Max.	Water temp. (C) Min.	Mean Air Temp. (C)
16-Jun	0	0	0	50.0				16.3
17-Jun	0	1	0	49.5	16.6	14.4	13.9	19.5
18-Jun	1	1	1	48.3	16.6	20.0	16.1	16.0
19-Jun	2	1	0	46.9	15.6	16.7	15.6	20.0
20-Jun	0	4	0	47.8	16.4	17.2	16.7	17.0
21-Jun	5	3	0	44.6	15.9	17.2	17.2	21.0
22-Jun	0	0	1	43.8	15.8	16.7	7.8	14.0
23-Jun	1	0	4	70.2	12.2	13.3	12.2	13.5
24-Jun	1	2	0	62.5	11.4	12.2	11.1	11.5
25-Jun	7	9	1	55.6	12.1	10.0	10.0	20.0
26-Jun	9	2	1	51.2	15.0	17.0	10.6	12.0
27-Jun	10	1	0	48.3	15.0	17.6	13.9	17.5
28-Jun	20	1	1	47.0	15.3	16.6	16.1	17.5
29-Jun	6	2	1	59.7	15.5	16.1	14.4	16.0
30-Jun	17	3	0	59.5	15.3	15.3	15.0	15.5
01-Jul	9	0	1	53.5	13.6	15.8	12.1	16.5
02-Jul	17	0	1	49.4	15.3	18.9	15.8	24.5
03-Jul	16	1	1	45.8	16.2	17.4	16.1	20.0
04-Jul	28	2	0	43.5	13.9	15.8	15.0	14.5
05-Jul	11	2	2	51.0	16.2	15.0	15.0	14.5
06-Jul	27	3	2	47.3	14.4	17.2	12.0	18.0
07-Jul	36	2	3	44.0	15.8	18.0	10.8	19.0
08-Jul	31	1	5	41.9	18.9	21.1	15.8	23.5
09-Jul	51	2	4	39.8	19.4	20.2	17.0	22.5
10-Jul	49	7	3	38.8	16.1	19.4	15.5	20.0
11-Jul	16	3	1	37.2	18.6	19.7	16.3	20.5
12-Jul	14	6	2	36.0	17.7	20.0	17.7	19.5
13-Jul	6	1	1	36.8	18.3	19.1	17.0	18.5
14-Jul	3	3	3	38.3	16.9	17.2	15.8	18.0
15-Jul	9	2	2	37.3	16.6	19.0	15.5	20.5
16-Jul	11	2	2	50.0	16.6	18.9	16.3	17.5
17-Jul	6	1	2	69.0	12.8	14.4	12.5	14.0
18-Jul	8	2	4	79.5	14.9	16.1	15.5	16.0
19-Jul	17	1	11	64.0	17.6	18.0	16.1	13.5
20-Jul	9	1	3	56.0	13.3	16.1	12.2	18.0
21-Jul	13	2	7	51.5	15.5	17.2	17.2	15.0
22-Jul *	7	1	7					
23-Jul *	7	1	1					
24-Jul	3	0	3	68.5	16.6	17.2	15.5	17.5
25-Jul	1	0	0	61.5	16.6	17.0	15.0	17.5
26-Jul	4	2	0	57.5	17.7	17.7	16.6	15.0
27-Jul	9	0	0	52.5	16.6	19.0	13.0	17.0
28-Jul	4	2	1	49.6	16.4	16.3	15.0	16.5
29-Jul	6	2	2	60.0	15.5	16.0	15.5	15.0
30-Jul	0	0	0	85.0	16.4	17.2	16.0	18.0
TOTAL	507	82	84					

* Estimated value during fence washout.

Table 6. Recreational catch and effort for small and large Atlantic salmon on the LaPoile River, 1993.

Location	Effort (rod days)	Catch: Small (<63cm) Retained	Small (<63cm) Released	Small (<63cm) Total	Large (>=63cm) Released	Total Catch	CPUE
Before counting fence operation:							
Unspecified location	46	1	0	1	0	1	0.02
During counting fence operation:							
Above fence	318	85	36	121	10	131	0.41
Below Fence	355	90	13	103	2	105	0.30
Unspecified location	99	19	1	20	2	22	0.22
Sub-total	772	194	50	244	14	258	0.33
After counting fence operation:							
Unspecified location	143	11	5	16	0	16	0.11
Total	961	206	55	261	14	275	0.29

Table 7. Estimation of angling exploitation rate (ER), returns and spawning escapement of small and large Atlantic salmon on the Lapoile River, 1993.

a. Estimation of Angling Exploitation Rate (ER) during counting fence operation:

$$ER = \frac{\text{(total \# small salmon retained above and below counting fence)}}{\text{(\# small counted at fence) + (total \# small retained below fence)*}}$$

$$ER = \frac{(85 + 90 + 19)}{(507) + (90 + 10)}$$

$$ER = \frac{194}{607}$$

$$ER = 0.3196$$

b. Estimation of small returns after fence operations:

$$\text{\# Small} = \frac{\text{\# small retained after counting fence operations}}{ER}$$

$$\text{\# Small} = \frac{11}{0.3196}$$

$$\text{\# Small} = 34.418$$

c. Estimation of large returns after fence operations:

\# Large = (\# small returns after fence operations) x (ratio of large to small at fence)
\# Large = 34.418 x 0.1617
\# Large = 5.57

d. Estimation of potential spawning escapement:

\# Small spawners = [(\# counted and estimated at fence) + (total \# small retained below fence)] − (\# retained during and after fence operation)
= [(507 + 34) + (90 + 10)] − (194 + 11)
= 436

\# Large spawners = (\# counted and estimated at fence)
= (82 + 6)
= 88

* The total number of small salmon angled below the counting fence includes the known number (90) and the number below the fence (10) from unspecified locations determined on the basis of a ratio of 85:90.

Table 8. Biological characteristics of Atlantic salmon on the LaPoile River, 1993.

	Freshwater Age Group	Fork Length (cm) N	Mean	Min.	Max.	S.D.	Gutted Weight (kg) N	Mean	Min.	Max.	S.D.	Percent Female No. Sexed	No. Female	%	Percent at Age No. at Age	%	Mean
Angling:																	
Small (<63 cm)																	
1SW	2	4	52.50	50.0	57.0	3.14	4	1.50	1.10	2.00	0.39	6	4	66.7	6	10.0	.
	3	26	53.90	49.0	61.0	2.76	30	1.54	1.00	2.00	0.25	37	31	83.8	37	61.7	.
	4	16	53.60	49.0	59.0	3.06	14	1.64	1.25	2.00	0.21	16	11	68.8	17	28.3	.
	Total	46	53.70	49.0	61.0	2.86	48	1.56	1.00	2.00	0.25	59	46	78.0	60	100.0	3.18
Previous	3	2	59.30	58.0	60.5	.	2	2.00	2.00	2.00	.	2	1	50.0	2	66.7	.
Spawners (CS)	4	1	57.00	57.0	57.0	.	1	1.80	1.80	1.80	.	1	1	100.0	1	33.3	.
	Total	3	58.50	57.0	60.5	1.80	3	1.90	1.80	2.00	0.14	3	2	66.7	3	100.0	3.33
	Total	53	54.10	49.0	61.0	3.06	55	1.60	1.00	2.80	0.30	66	50	75.8	63	.	3.19
Counting Fence:																	
Small (<63 cm)		45	53.97	43.5	62.0	4.63	.	.	.	.	.	45	35	77.8	.	.	.
Large (>=63 cm)		50	70.20	63.0	84.1	5.50	.	.	.	.	.	50	34	68.0	.	.	.

S.D. refers to standard deviation.

Table 9. Estimation of Atlantic salmon egg deposition and percentage conservation requirement achieved on the LaPoile River in 1993.

a. Rearing Habitat and Egg Deposition Rates:

Fluvial Rearing Units (100 sq. m)	21,457	(Anon.)
Accessible Lacustrine Area (ha)	519	(topographic maps)
Egg Deposition To Achieve Reference Target:	240 eggs per Rearing Unit (100 sq. m)	(Elson, 1957)
	368 eggs per hectare of Lacustrine Area	(O'Connell et al., 1991)

b. Biological Characteristics:

Fecundity		1,540 eggs / kg	
Small – (<63 cm)	% overall	86.1	(fence, 1993)
	% female	75.8	(recreational, 1993)
	mean wt. female	1.77 kg (N=48)	(recreational, 1993)
Large – (>=63 cm)	% overall	13.9	(fence, 1993)
	% female	68.0	(fence, 1993)
	mean wt	3.7 + kg	(Porter and Chadwick, 1983)

c. Estimation of Percent of Target Egg Requirements Achieved in 1993:

$$\%\ \text{Target Achieved} = \text{potential egg depositions} \ / \ \text{minimum conservation requirement} \times 100$$

$$= \frac{(\text{small spawners} * \%\text{female} * \text{mean wt} * \text{fecundity}) + (\text{large spawners} * \%\text{female} * \text{mean wt} * \text{fecundity})}{(\text{Rearing Units} * \text{Optimum Egg Deposition}) + (\text{Lacustrine Area} * \text{Optimum Egg Deposition})} \times 100$$

$$= \frac{(436 * .758 * 1.77 * 1{,}540) + (88 * .68 * 3.7 * 1{,}540)}{(21457 * 240) + (519 * 368)} \times 100$$

$$= \frac{1{,}241{,}813}{5{,}340{,}672} \times 100$$

$$= 23\%$$

Table 10. Atlantic salmon assessment results for 1993 and retrospective analysis for 1974–1992 based on angling catches.

STOCK: LaPoile River, SFA 12
MINIMUM REQUIREMENT RECOMMENDED FOR OPTIMUM EGG DEPOSITION: 5.3 million eggs

Year	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Angling Catch (retained):																				
Small *	73	55	34	126	32	97	148	184	325	41	274	126	238	255	204	153	219	262	194	206
Large **	2	3	2	3	2	3	3	1	2	2	0	19	24	18	7	6	19	8	40	14
Fence Counts:																				
Small	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	541
Large	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	88
Estimated Returns *:**																				
Small	228	172	106	394	100	304	463	576	1017	128	857	394	745	798	638	479	685	820	607	642
Large	37	28	17	64	16	49	75	93	165	21	139	64	121	129	104	78	111	133	99	88
Estimated Spawning Escapement (total returns – angling catch):																				
Small	155	117	72	268	68	207	315	392	692	87	583	268	507	543	434	326	466	558	413	436
Large	37	28	17	64	16	49	75	93	165	21	139	64	121	129	104	78	111	133	99	88
% of Target Egg Deposition (Small + Large):																				
	9	7	4	15	4	12	18	22	39	5	33	15	28	30	24	18	26	31	23	23

* Small salmon are retained catches only. Note that the 1992 and 1993 catches of small salmon were affected by the zonal quotas.
** Large salmon were required to be released from 1984 to 1993.
** Estimated returns for 1974–1992 are based on angling exploitation rate of 0.3196 derived for small salmon in 1993.

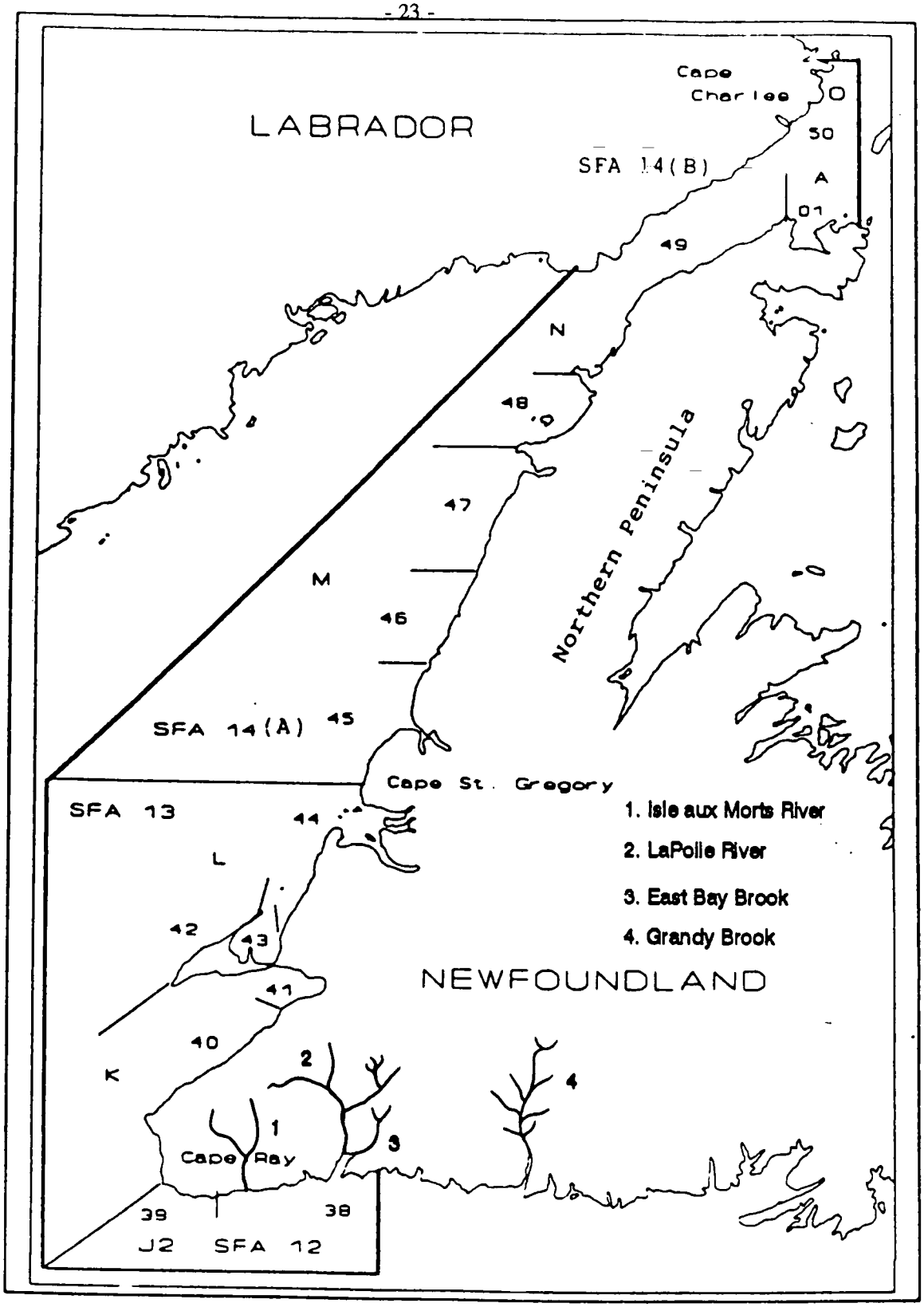


Figure 1. Location of rivers in Salmon Fishing Area 12.

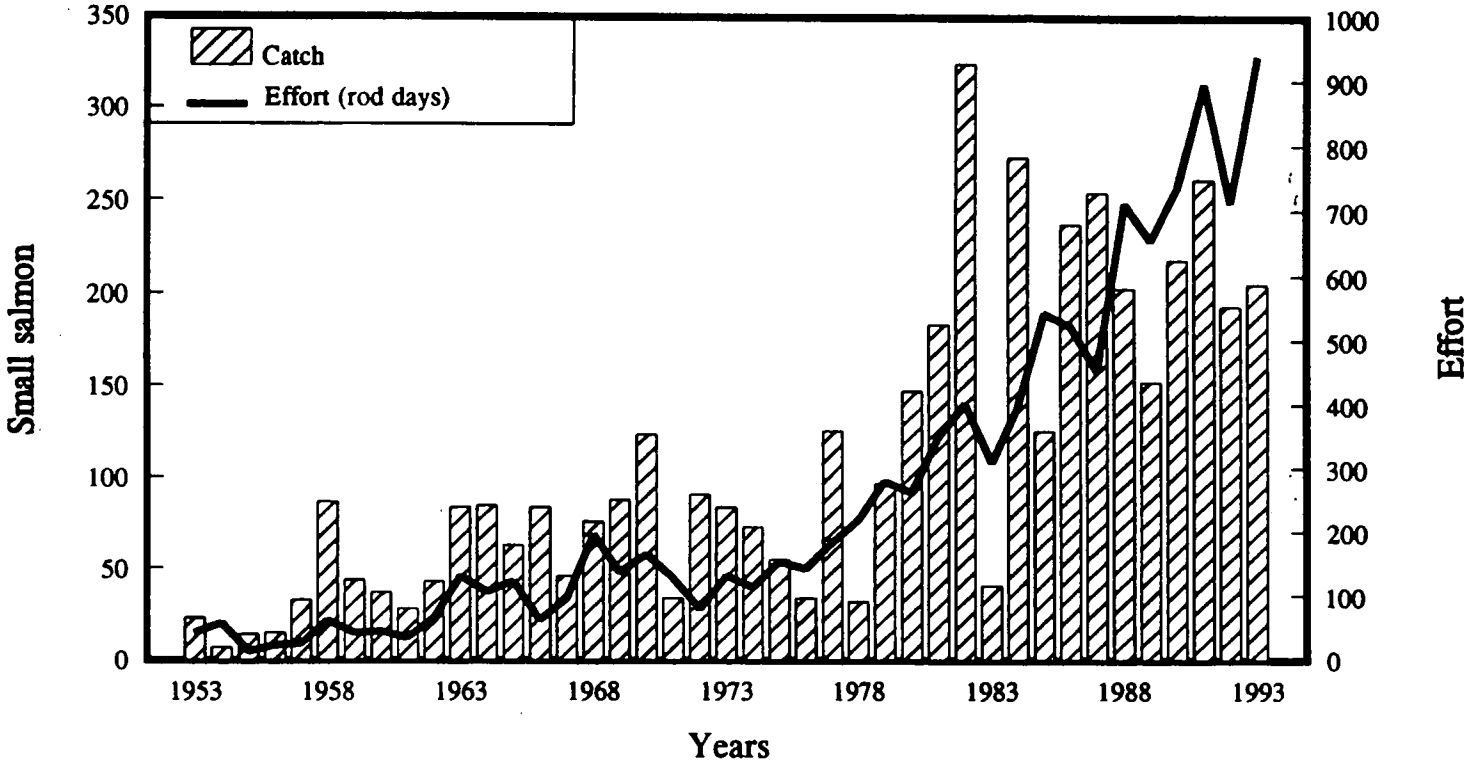


Figure 2. Recreational catch and effort on the LaPoile River, 1953-1993. Catches are retained fish only.

Figure 3. The location of the counting fence on left and barrier fence on right, LaPoile River, 1993.

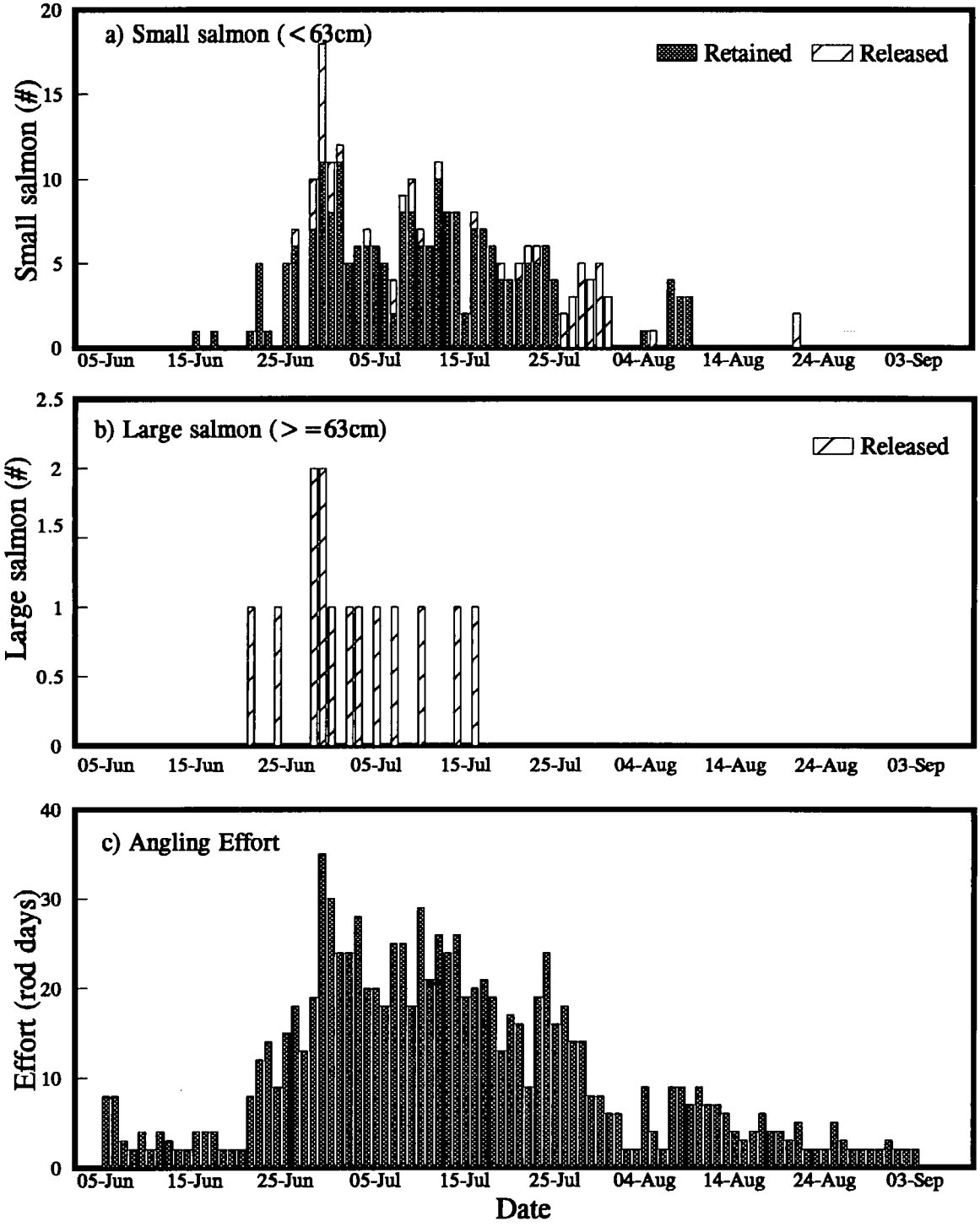


Figure 4. Distribution of retained and released catches of small and large Atlantic salmon and angling effort on the LaPoile River, 1993.

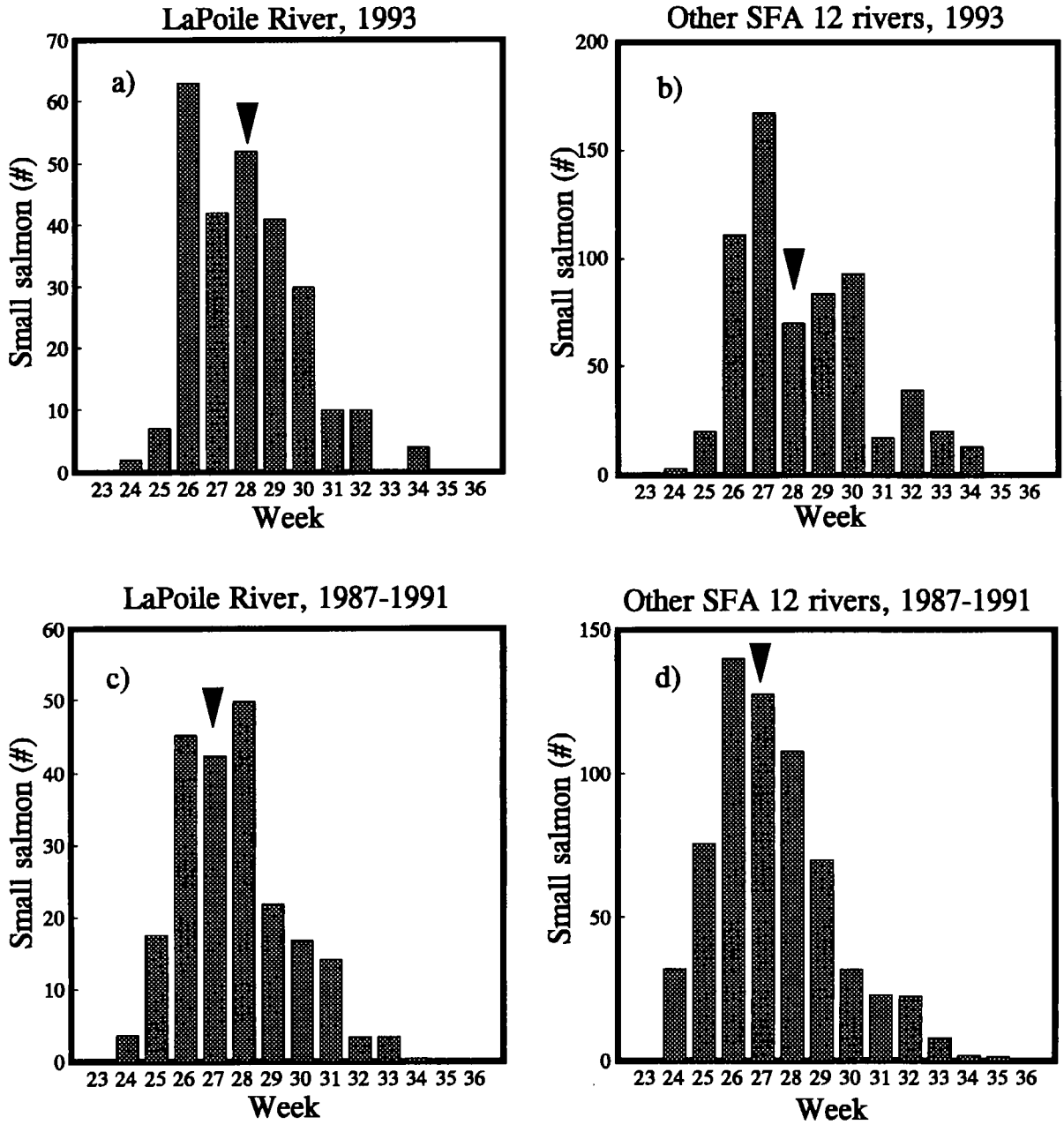


Figure 5. Weekly angling catch of small Atlantic salmon on the LaPoile River and other SFA 12 rivers in 1993 and 1987-1991 means. Arrows indicate the run-timing of salmon in 1993 relative to the 1987-1991 means.

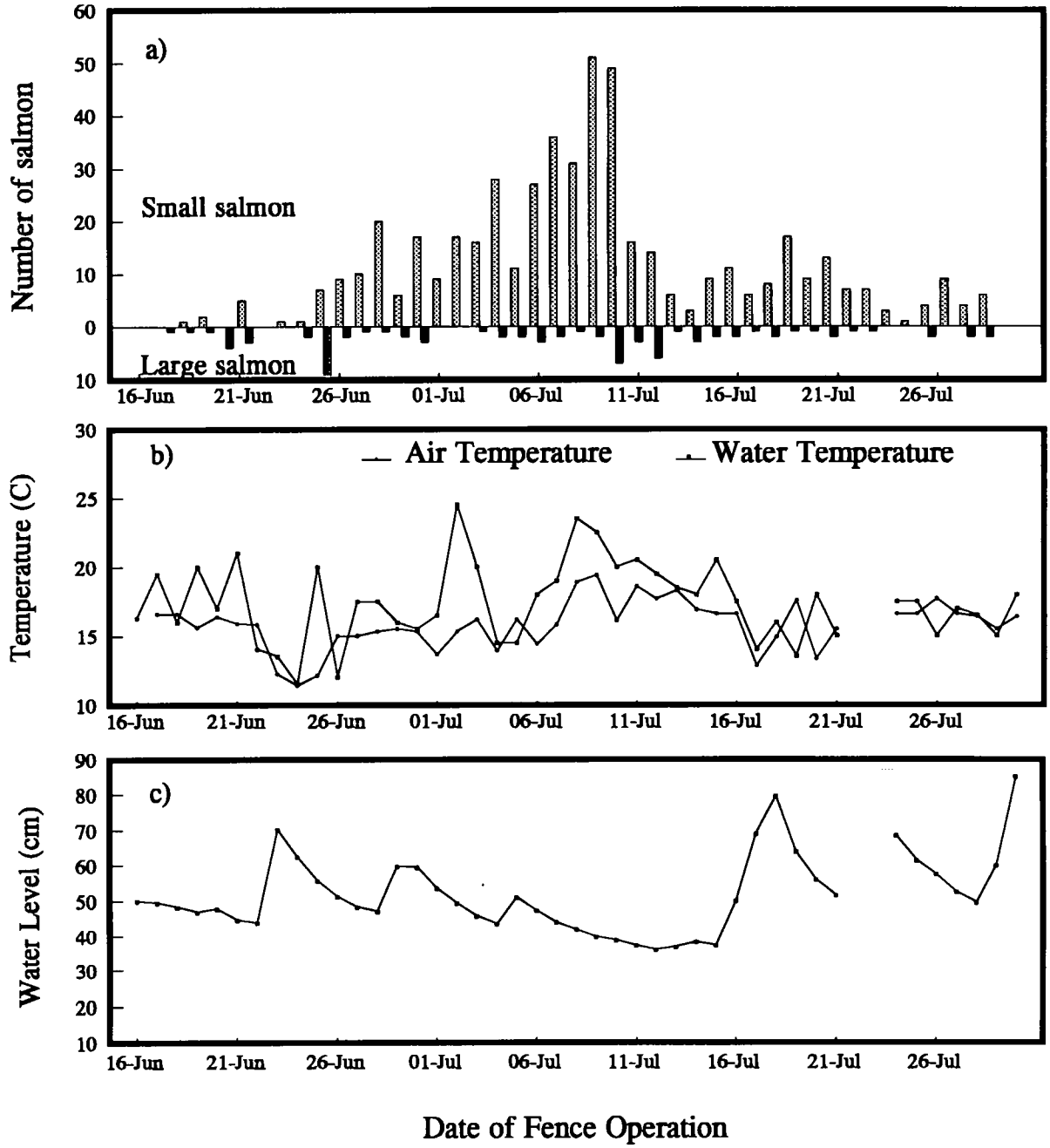
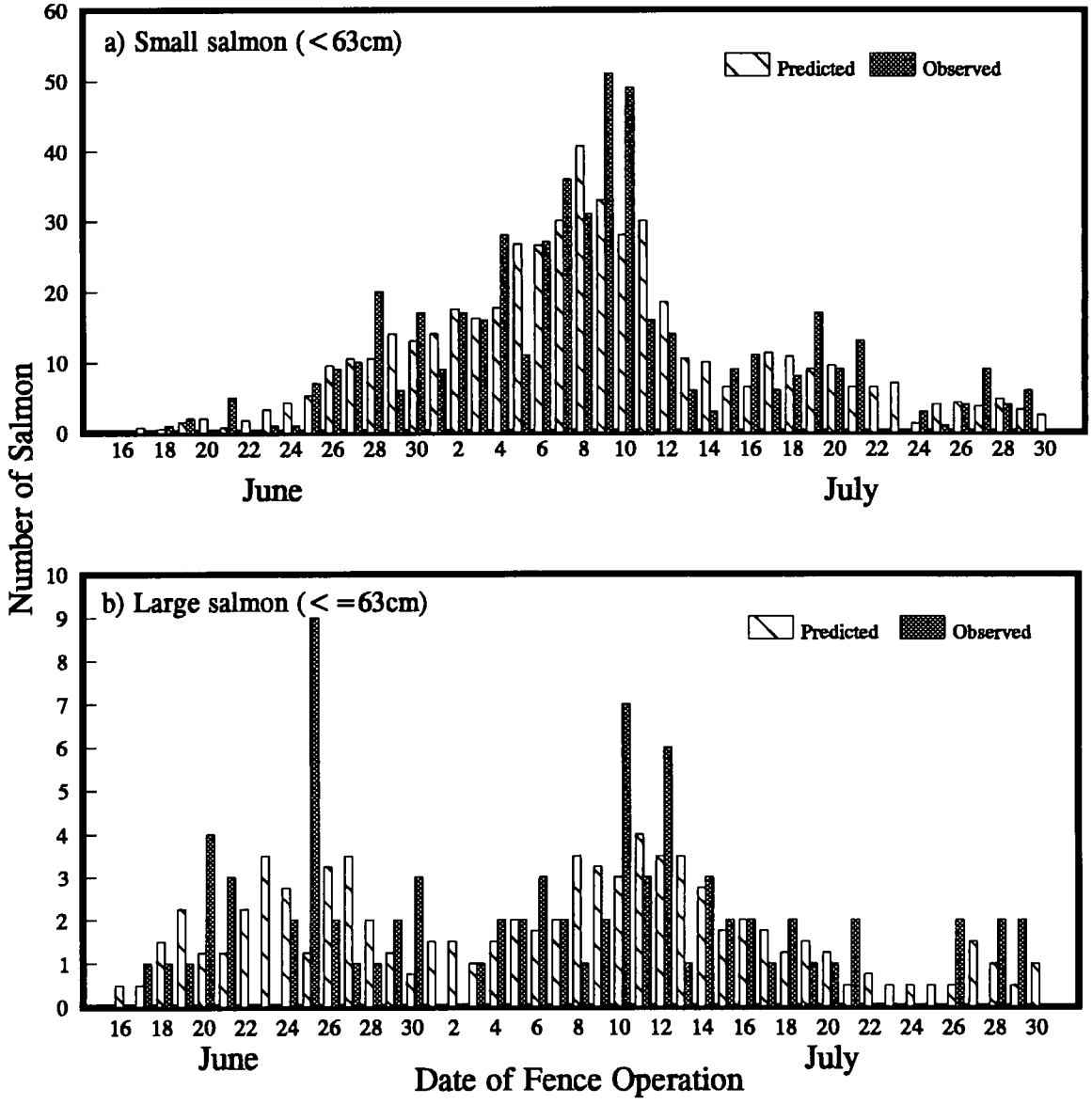


Figure 6. Daily counts of small and large Atlantic salmon, mean air and water temperature, and water level recorded at the counting fence on LaPoile River, 1993.



Note: Fence out July 22-23.

Figure 7. Predicted and observed counts of small and large Atlantic salmon that passed through the counting fence on the LaPoile River in 1993.

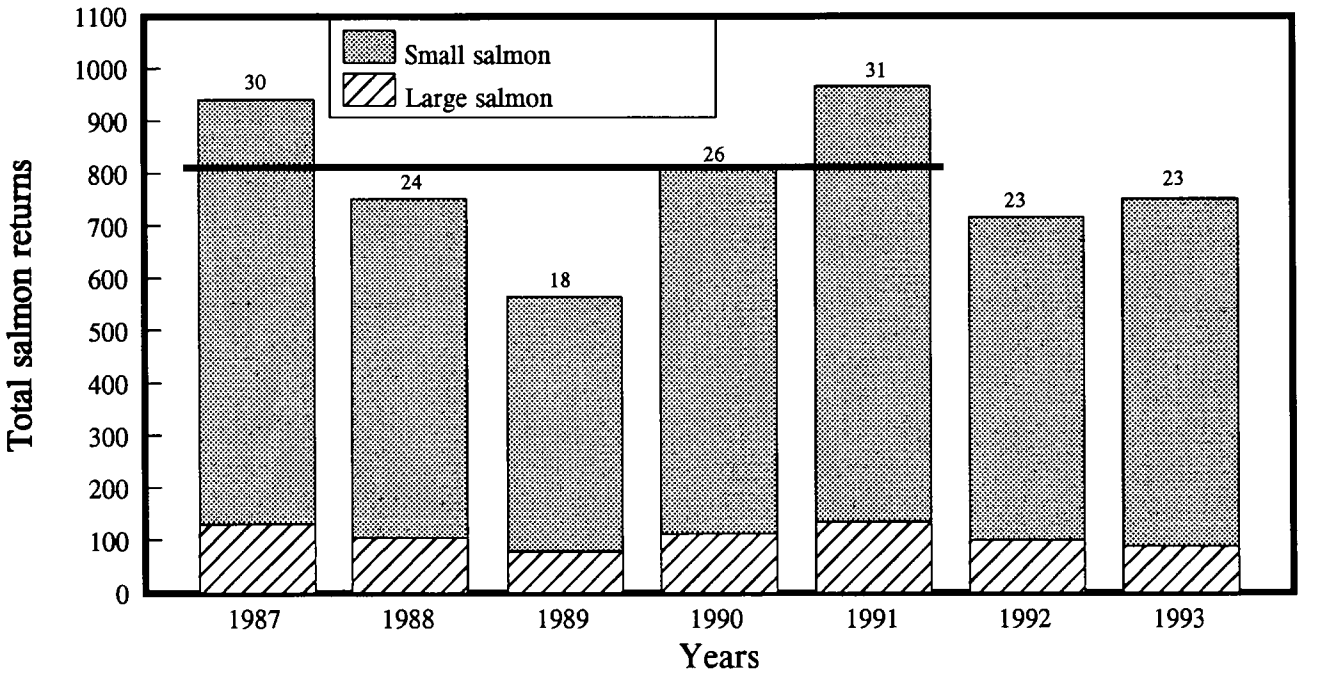


Figure 8. Total returns of small and large Atlantic salmon to the LaPoile River in 1987-1993. Horizontal line represents the 1987-1991 mean and numbers above the bars represent the percent of the target spawning escapement achieved.

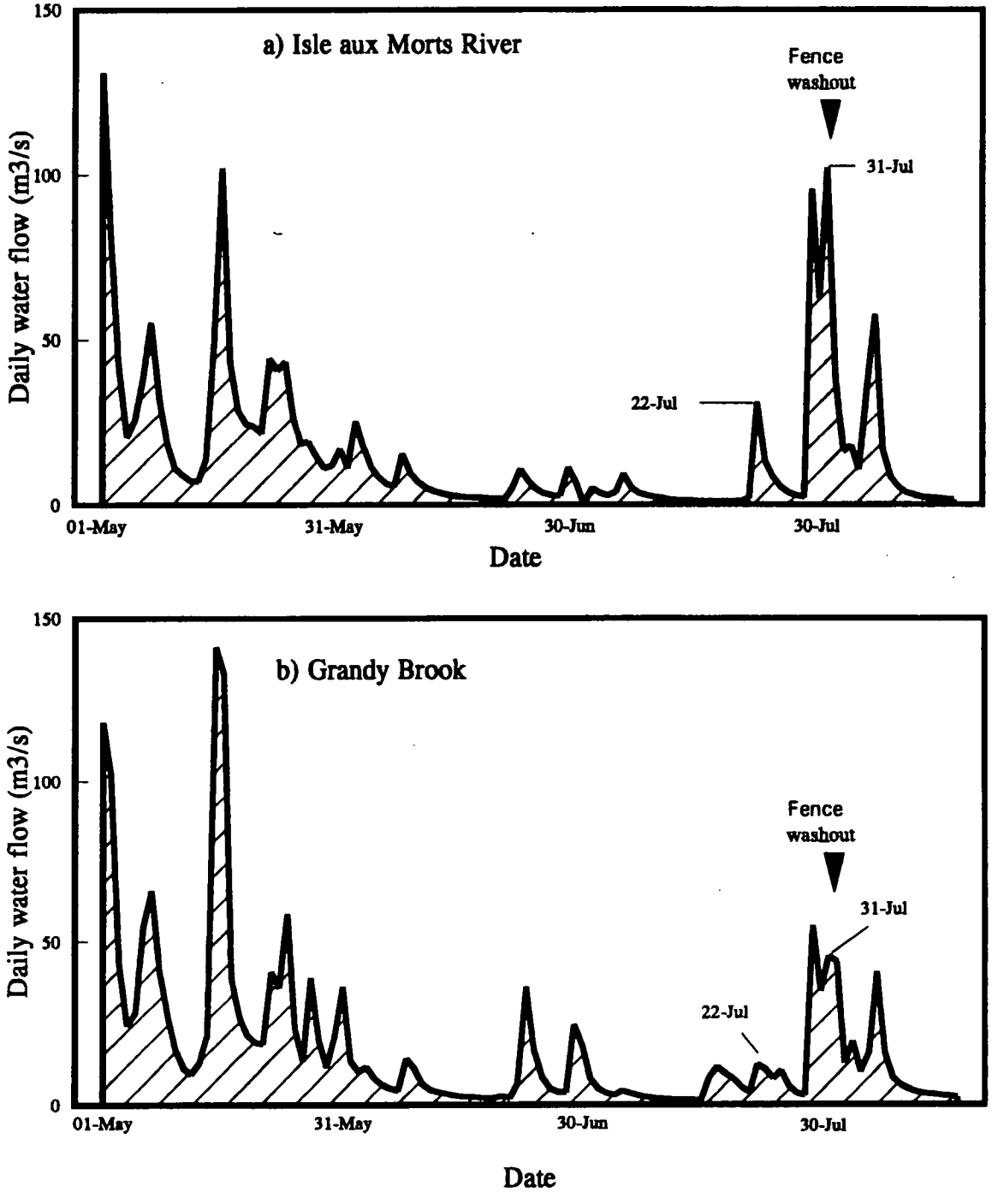


Figure 9. Daily water flow on Isle aux Morts River and Grandy Brook, May 1 to August 16, 1993.

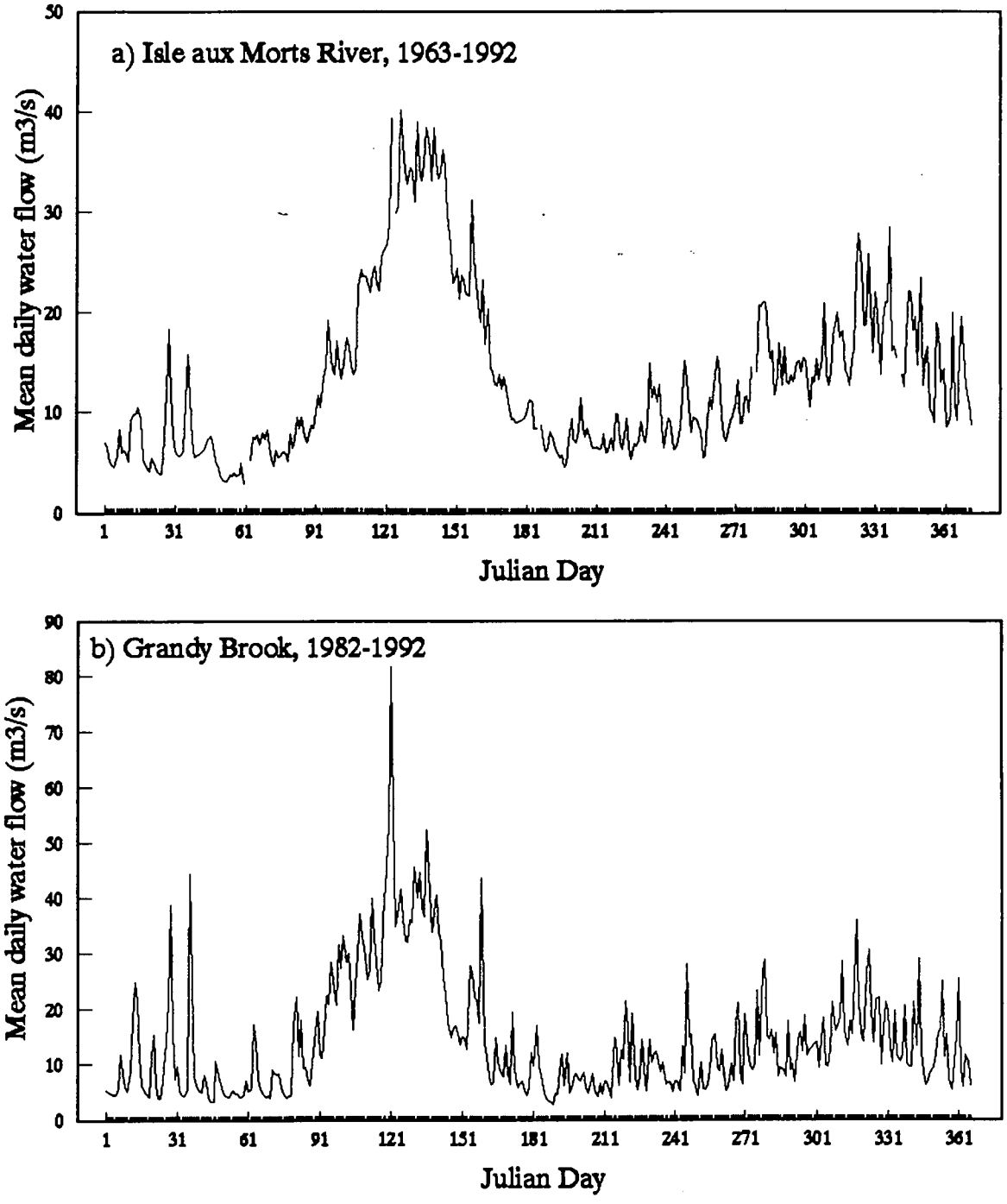


Figure 10. Mean daily water flow on Isle aux Morts River, 1963-1992 and Grandy Brook, 1982-1992.

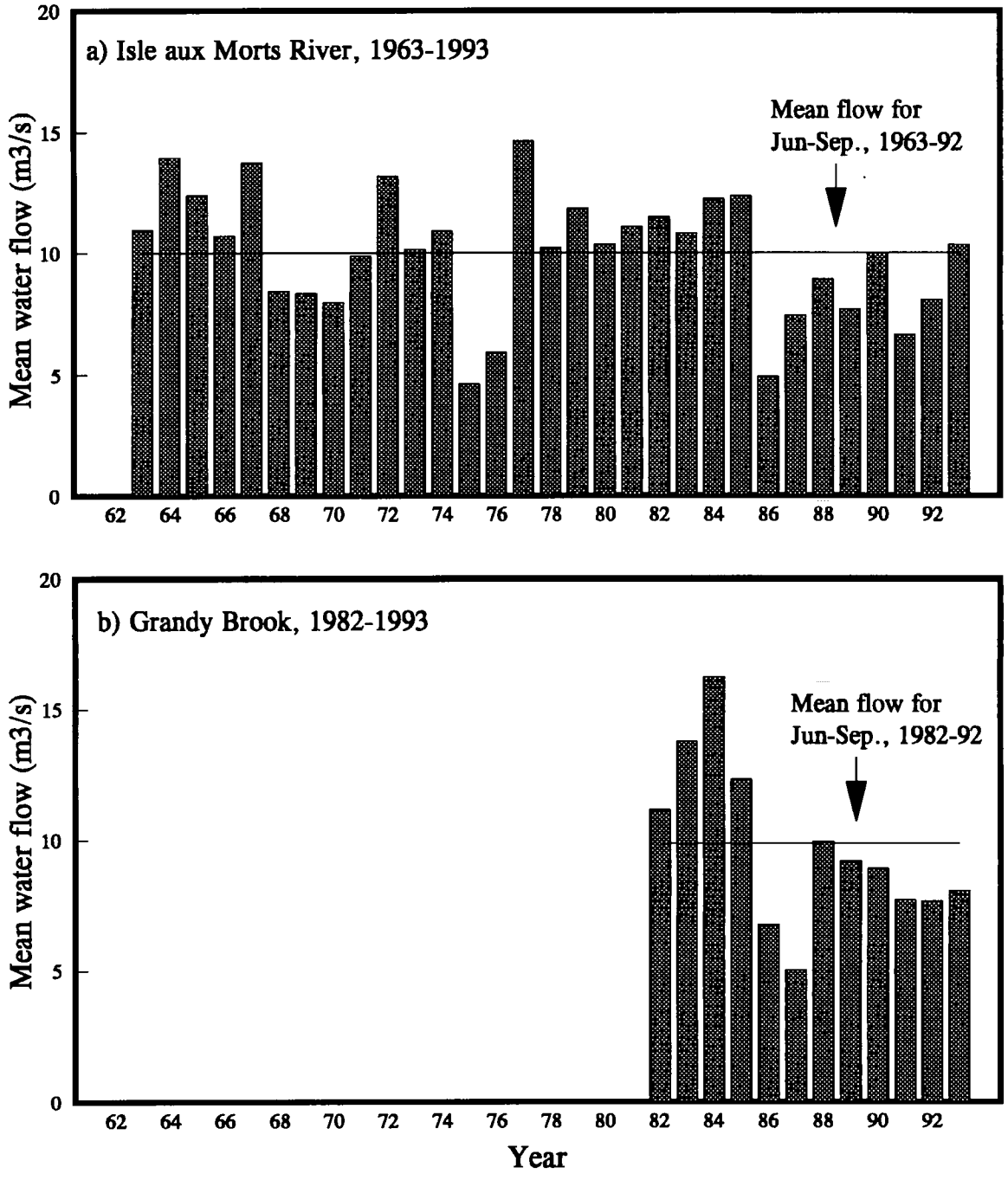


Figure 11. Mean water flow from June 1 to September 30 for Isle aux Morts River, 1963-1992 and Grandy Brook, 1982-1993.

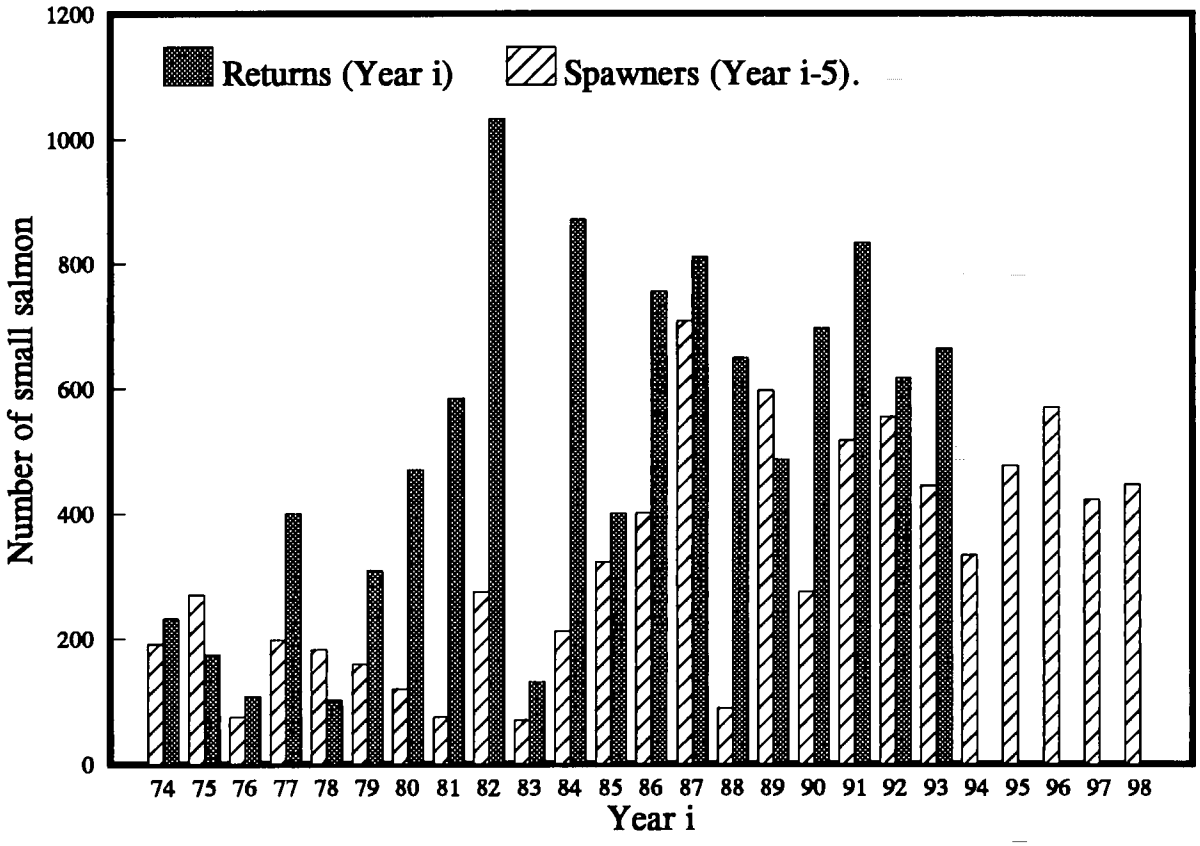


Figure 12. Estimated returns in year i and spawners in year i-5 of small salmon on the LaPoile River in 1974-1998.

Appendix 1. Conversion of Atlantic salmon gutted weight (GGWT) into whole weight (WWT). Weights were obtained from Humber River salmon, 1991–1993.

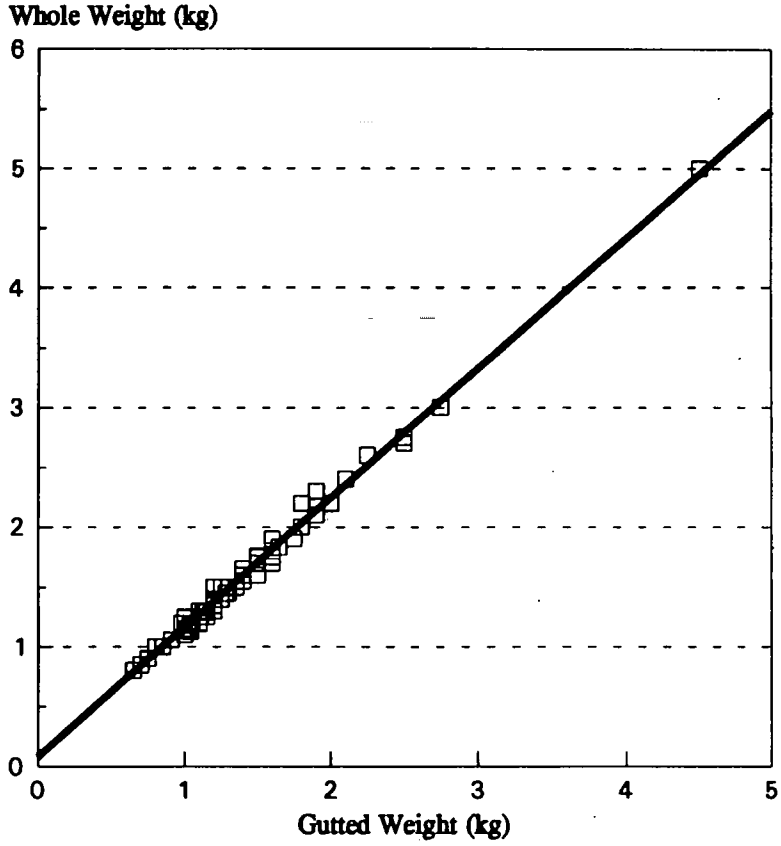
YY	WWT (KG)	GGWT (KG)
93	0.80	0.65
93	0.90	0.75
93	1.00	0.85
93	1.00	0.80
93	1.10	1.00
93	1.10	1.00
93	1.15	1.00
93	1.20	1.00
93	1.20	1.10
93	1.20	1.05
93	1.20	1.00
93	1.25	1.10
93	1.25	1.00
93	1.25	1.10
93	1.25	1.10
93	1.25	1.00
93	1.25	1.10
93	1.25	1.10
93	1.25	1.00
93	1.30	1.15
93	1.30	1.10
93	1.30	1.15
93	1.30	1.15
93	1.30	1.15
93	1.40	1.25
93	1.40	1.20
93	1.40	1.25
93	1.40	1.20
93	1.40	1.25
93	1.40	1.20
93	1.40	1.25
93	1.40	1.25
93	1.40	1.25
93	1.40	1.25
93	1.50	1.20
93	1.50	1.25
93	1.50	1.30
93	1.50	1.30
93	1.50	1.35
93	1.50	1.20
93	1.55	1.40
93	1.60	1.40
93	1.60	1.40
93	1.70	1.50
93	1.75	1.50
93	1.75	1.50
93	1.76	1.50
93	2.20	1.80
93	2.20	2.00
93	2.30	1.90
93	2.40	2.10
93	2.60	2.25
93	5.00	4.50
92	3.00	2.75
92	2.75	2.50
92	2.70	2.50
92	2.10	1.90
92	2.00	1.80
92	1.90	1.75
92	1.90	1.75
92	1.80	1.60
92	1.80	1.60
92	1.75	1.60
92	1.70	1.60
92	1.60	1.50
92	1.50	1.20
92	1.40	1.25
92	1.40	1.20
92	1.20	1.00
92	1.00	0.80
92	1.00	0.85
92	0.90	0.75
91	1.90	1.60
91	1.83	1.65
91	1.65	1.40
91	1.50	1.30
91	1.50	1.35
91	1.50	1.30
91	1.45	1.30
91	1.45	1.30
91	1.45	1.28
91	1.40	1.20
91	1.40	1.20
91	1.40	1.20
91	1.40	1.20
91	1.40	1.25
91	1.40	1.25
91	1.40	1.20
91	1.35	1.20
91	1.30	1.10
91	1.30	1.10
91	1.30	1.20
91	1.30	1.13
91	1.29	1.12
91	1.29	1.14
91	1.25	1.15
91	1.25	1.11
91	1.20	1.10
91	1.20	0.98
91	1.18	1.04
91	1.14	1.02
91	1.13	1.04
91	1.06	0.91
91	0.85	0.70
MEAN	1.51	1.32
N	104	104
MIN	0.80	0.65
MAX	5.00	4.50

Regression Output:

Constant		0.000
Std Err of Y Est		0.061
R Squared		0.987
No. of Observations		104.000
Degrees of Freedom		103.000
X Coefficient(s)	1.136	
Std Err of Coef.	0.004	

WWT = 1.136 * GGWT

WWT	GGWT
1.136	1.00



Appendix 2. Stream survey data sheet. Condensed from Scruton et al. (1992).

Stream survey sheet

Section No.:_____

Date: _____ Stream order: _____

Time: _____ Map Reference:_____

Stream name:_____ Water level(l/m/h): _____

Tributary of:_____ Water temp(°C): _____
Tributary No.:_____ Air temp(°C): _____
Section length(m): _____ Weather comment: _____

	UPPER	MIDDLE	LOWER	MEAN
WATER WIDTH (m)				
CHANNEL WIDTH (m)				
BANK HEIGHT (m)	LEFT RIGHT	LEFT RIGHT	LEFT RIGHT	LEFT RIGHT
ICE SCOUR HEIGHT (m)	LEFT RIGHT	LEFT RIGHT	LEFT RIGHT	LEFT RIGHT
WATER DEPTH (cm)	1. 2. 3. TOT: +	1. 2. 3. TOT: +	1. 2. 3. TOT: =	/10=

Surface velocity(m/s): 1 _____
2 _____ Mean: _____
3 _____

Habitat characteristics (%): Pool _____ Riffle _____
Run _____ Steady _____
Flat _____ Rapids _____
Other _____

Bottom Composition(%):
Bedrock _____ Lg Boulders(> 1m dia.) _____
Sm Boulders(25cm-1m) _____ Rubble(14-25cm) _____
Cobble (6-13cm) _____ Sand (0.06-20mm) _____
Gravel (20mm-3cm) _____ Pebble (3-5cm) _____
Mud/Clay(0.004-0.05mm) _____

Appendix 2 Continued

Vegetation Cover(%):
Overhanging _____
Instream (in the stream bed) _____
Instream (aquatic vegetation) _____
Canopy (trees along bank) _____

Riparian habitat(%):
Hardwood _____ Shrubs _____
Softwood _____ Grasses _____
Alders _____ Bog _____

Stream bank erosion(%): left: right:

Pool Characteristics:

Pool/riffle ratio: _____

Pool no. ___	Pool no. ___	Pool no. ___
Length(m): _____	Length(m): _____	Length(m): ____
Width (m): _____	Width (m): _____	Width (m): ____
Depth (cm):_____	Depth (cm):_____	Depth (cm:)____

Note: Find these measurements for each pool in the section.

Obstruction:
Obstructions (y/n): ____ Type: _____

Vertical height(m): _____
Width (m): _____
Length(m): _____

Provide any other relevant description of the obstruction.

Diagram:

Include location of cross-sections, pools, undercut and eroding banks, obstructions (in detail, separate drawing), springs, tributaries, and other points of interest and major landmarks, i.e. instream debris, culverts, sewer outfalls, etc.).

Appendix 3. Length of accessible and inaccessible streams and lake area measured on the LaPoile River system in 1993.

Stream Name	Stream Order 1st (km)	2nd (km)	3rd (km)	4th (km)	5th (km)	Total Stream Length (km)*	Lake area (ha)**
Accessible areas:							
Bunker Hill Brook	42.2	15.5	10.9	8.9	0.0	77.5	164.8
Burke Brook	18.5	5.1	6.5	0.0	0.0	30.1	112.8
Deep Brook	16.3	5.8	13.3	0.0	0.0	35.3	79.2
LaPoile River	46.1	16.1	2.5	2.2	41.7	108.6	294.4
Big Pond Brook	1.7	0.0	0.0	0.0	0.0	1.7	84.6
Rocky Ridge Brook	4.2	2.0	0.0	0.0	0.0	6.2	38.4
Woody Brook	2.8	1.1	0.0	0.0	0.0	3.9	2.4
Round Hill Brook	8.9	3.3	4.3	0.0	0.0	16.5	35.2
Casade Brook	2.0	3.3	0.0	0.0	0.0	5.3	10.4
North Bay	6.7	2.1	1.1	0.0	0.0	8.7	413.6
Sub–total	149.3	54.1	38.5	1.1	41.7	293.6	1235.8
Inaccessible areas:							
Salmon Hole Brook	6.8	6.8	0.0	0.0	0.0	13.6	12.0
Northwest Brook	24.5	6.0	7.4	0.0	0.0	37.9	75.2
Dashwood Pond	22.2	4.3	0.3	0.0	0.0	26.8	1577.6
Morg Keeping Brook	33.7	15.6	7.0	10.3	0.0	66.6	604.2
Fox Hole Brook	18.4	9.5	5.6	2.4	0.0	35.9	131.2
Big Otter Pond	10.2	8.8	0.9	2.7	0.0	22.7	113.6
Map 12B/4	7.1	8.0	0.0	0.0	0.0	7.9	65.6
Sub–total	122.9	59.0	21.2	15.4	0.0	211.2	2579.4
TOTAL	272.3	113.1	59.7	26.5	41.7	504.8	3815.2

*includes rivers < 1km

**includes lakes < 5ha

Appendix 4. Results of partial stream survey of LaPoile River in 1993.

Section Number	Section Length (m)	Stream Order	Water Width (m)	Habitat Type(%)						Bottom Composition(%)									Bottom Rearing Area (m2)	Rearing Units (100m2)
				Pool	Run	Flat	Riff	Stdy	Rpds	Bdr	Bld	Cob	Grv	Rub	Mud	San	Peb	Sbl		
Main river above the counting fence.																				
1	91	5	30.1	0	0	0	0	100	0	0	31	0	0	69	0	0	0	0	2742	27.42
2	100	5	33.7	0	0	0	0	100	0	0	33	40	0	37	0	0	0	0	3367	33.67
3	100	5	45.0	0	0	0	0	100	0	0	50	15	2	33	0	0	0	0	4500	45.00
4	100	5	52.7	0	90	0	0	10	0	0	40	18	2	40	0	0	0	0	5267	52.67
5	100	5	59.3	0	0	0	0	100	0	0	41	0	9	40	0	0	10	0	5933	59.33
6	100	5	64.0	0	0	0	0	100	0	0	5	35	0	60	0	0	0	0	6400	64.00
7	100	5	65.3	0	0	0	0	100	0	0	12	46	2	40	0	0	0	0	6533	65.33
8	100	5	50.0	0	10	0	0	90	0	0	13	7	0	80	0	0	0	0	5000	50.00
9	100	5	50.7	0	50	0	0	50	0	0	20	20	10	50	0	0	0	0	5067	50.67
10	100	5	22.7	0	0	0	0	100	0	0	20	38	2	40	0	0	0	0	2267	22.67
11	100	5	55.0	0	0	0	0	100	0	0	20	20	10	50	0	0	0	0	5500	55.00
12	100	5	87.7	0	100	0	0	0	0	0	32	38	0	30	0	0	0	0	8773	87.73
13	100	5	67.2	0	0	0	0	100	0	0	30	35	0	30	0	0	5	0	6723	67.23
14	100	5	50.2	0	0	0	0	100	0	0	17	40	0	38	0	0	5	0	5017	50.17
15	100	5	44.3	0	0	0	0	100	0	0	25	40	0	30	0	0	5	0	4433	44.33
16	100	5	66.4	0	0	0	0	100	0	0	50	28	15	5	0	2	0	0	6637	66.37
17	100	5	60.0	0	0	0	0	100	0	0	50	30	5	10	0	5	0	0	5997	59.97
18	100	5	34.4	0	0	0	0	100	0	0	30	30	5	30	0	0	5	0	3440	34.40
19	100	5	49.6	0	0	0	100	0	0	0	90	5	0	5	0	0	0	0	4960	49.60
20	100	5	70.3	0	20	0	80	0	0	0	5	40	0	55	0	0	0	0	7030	70.30
21	100	5	84.0	0	0	0	100	0	0	0	0	50	0	50	0	0	0	0	8400	84.00
22	50	5	69.0	0	0	0	0	100	0	0	1	70	0	29	0	0	0	0	3450	34.50
1	100	5	38.3	60	10	0	0	0	30	0	1	50	0	49	0	0	0	0	3830	38.30
2	100	5	21.0	60	20	0	0	0	20	0	7	40	0	53	0	0	0	0	2100	21.00
1a	100	5	27.3	100	0	0	0	0	0	0	0	50	0	50	0	0	0	0	2730	27.30
2a	100	5	22.7	30	20	0	0	0	50	0	15	30	0	50	0	0	5	0	2270	22.70
3a	100	5	31.3	0	40	0	30	10	20	0	10	40	0	40	0	0	10	0	3130	31.30
3	100	5	22.0	10	20	0	60	10	0	0	5	30	0	50	0	5	10	0	2200	22.00
4	100	5	29.7	0	40	0	40	10	10	0	5	60	0	30	0	0	5	0	2970	29.70
5	100	5	46.3	50	20	0	10	20	0	0	5	40	5	40	0	0	10	0	4630	46.30
6	100	5	52.3	60	20	0	0	20	0	0	10	40	10	30	0	5	5	0	5230	52.30
7	100	5	44.7	0	50	0	20	30	0	0	50	20	0	30	0	0	0	0	4470	44.70
8	100	5	28.0	10	30	0	20	20	20	0	30	20	0	30	5	10	5	0	2800	28.00
9	100	5	27.3	0	30	0	20	10	40	0	20	30	10	30	0	0	10	0	2730	27.30
10	100	5	28.3	0	40	0	20	20	20	0	10	40	10	25	0	5	10	0	2830	28.30
11	100	5	31.0	0	60	0	20	20	0	0	30	20	10	20	0	10	10	0	3100	31.00
12	100	5	32.3	20	20	0	10	20	30	0	40	10	5	30	0	5	10	0	3230	32.30
13	100	5	30.3	10	30	0	10	0	50	0	30	30	0	20	10	0	10	0	3030	30.30
14	100	5	36.7	60	0	0	20	0	20	0	20	40	0	40	0	0	0	0	3670	36.70
15	100	5	36.1	60	0	0	0	0	40	0	40	30	0	30	0	0	0	0	3610	36.10
16	100	5	34.0	0	50	0	20	0	30	0	5	50	0	40	0	0	5	0	3400	34.00
17	100	5	30.7	0	40	0	40	0	20	0	0	40	0	40	0	0	20	0	3070	30.70
18	100	5	33.7	30	20	0	30	0	20	0	10	25	0	35	20	0	10	0	3370	33.70
19	100	5	49.0	60	0	0	20	20	0	0	10	30	5	40	0	0	15	0	4900	49.00
20	100	5	60.0	50	0	0	0	50	0	0	0	45	0	45	0	10	0	0	6000	60.00
21	100	5	78.7	50	0	0	0	50	0	0	20	10	0	10	0	0	60	0	7870	78.70
22	100	5	65.3	0	20	0	80	0	0	0	30	30	0	30	0	0	10	0	6530	65.30
23	100	5	52.7	0	20	0	80	0	0	0	30	30	0	30	0	0	10	0	5270	52.70
24	100	5	62.0	50	0	0	0	50	0	0	20	15	30	15	0	10	10	0	6200	62.00
25	100	5	54.5	50	0	0	0	50	0	0	20	30	10	30	0	0	10	0	5450	54.50
26	100	5	45.5	60	0	0	20	0	20	0	20	30	0	30	0	0	20	0	4550	45.50
27	100	5	69.7	0	0	0	50	0	50	0	40	20	10	20	0	0	10	0	6970	69.70
28	100	5	89.3	0	60	0	40	0	0	0	7	40	1	40	0	2	10	0	8930	89.30
29	100	5	76.0	50	0	0	0	50	0	0	20	30	0	30	0	10	10	0	7600	76.00
30	100	5	60.0	50	0	0	0	50	0	0	30	0	0	20	0	40	10	0	6000	60.00
31	100	5	39.7	50	0	0	0	50	0	0	0	0	0	0	0	0	0	100	3970	39.70
32	100	5	24.3	50	0	0	0	50	0	0	30	0	0	0	0	0	0	70	2430	24.30
33	100	5	19.3	70	30	0	0	0	0	0	5	0	0	0	0	20	0	75	1930	19.30
34	100	5	21.0	0	20	0	60	0	20	0	40	20	0	20	0	0	20	0	2100	21.00
35	100	5	26.3	0	30	0	10	0	60	0	20	40	0	30	0	0	10	0	2630	26.30
36	100	5	47.7	0	10	0	20	0	70	0	20	30	0	30	0	0	20	0	4770	47.70
37	100	5	53.3	0	20	0	60	0	20	0	40	20	10	20	0	0	10	0	5330	53.30
38	100	5	46.0	50	30	0	20	0	0	50	40	5	0	5	0	0	0	0	4600	46.00
39	100	5	31.3	20	20	0	0	0	60	20	40	20	0	20	0	0	0	0	3130	31.30
40	100	5	41.0	0	60	0	20	10	10	0	40	30	0	30	0	0	0	0	4100	41.00
1	100	5	21.0	40	30	0	10	0	20	0	20	40	0	30	0	0	10	0	2100	21.00
2	84	5	16.5	0	20	0	20	60	0	0	25	30	0	30	0	0	15	0	1386	13.86
41	100	5	39.7	0	0	0	0	0	100	0	50	20	0	20	0	0	10	0	3970	39.70
42	100	5	36.0	0	50	0	50	0	0	0	20	30	10	30	0	0	10	0	3600	36.00
43	100	5	34.0	0	60	0	40	0	0	0	20	30	10	30	0	0	10	0	3400	34.00
44	100	5	45.7	0	100	0	0	0	0	0	20	30	10	30	0	0	10	0	4570	45.70
45	100	5	50.3	20	80	0	0	0	0	10	10	40	0	40	0	0	0	0	5030	50.30
46	100	5	45.7	0	0	0	20	0	80	15	25	30	0	30	0	0	0	0	4570	45.70
47	100	5	55.0	0	0	0	20	0	80	0	0	40	0	40	20	0	0	0	5500	55.00
48	100	5	46.0	0	0	0	40	0	60	0	50	20	0	20	10	0	0	0	4600	46.00
49	100	5	42.3	0	0	0	40	0	60	10	30	20	0	20	10	0	10	0	4230	42.30
50	100	5	39.3	0	80	0	20	0	0	10	30	20	0	20	0	0	20	0	3930	39.30

Appendix 4 Continued

Section Number	Section Length (m)	Stream Order	Water Width (m)	Habitat Type(%)						Bottom Composition(%)									Bottom Area (m2)	Rearing Units (100m2)
				Pool	Run	Flat	Riff	Stdy	Rpds	Bdr	Bld	Cob	Grv	Rub	Mud	San	Peb	Shl		
Main river above the counting fence (continued).																				
51	100	5	41.3	0	0	0	0	0	100	0	30	30	0	30	0	0	10	0	4130	41.30
52	100	5	55.0	0	0	0	50	0	50	0	40	20	0	20	0	0	20	0	5500	55.00
53	100	5	61.0	0	90	0	10	0	0	0	30	20	10	20	0	10	10	0	6100	61.00
54	100	5	54.0	0	0	0	100	0	0	0	25	20	5	20	0	0	30	0	5400	54.00
55	100	5	46.7	0	20	0	60	0	20	0	40	20	10	20	0	0	10	0	4670	46.70
56	100	5	50.0	0	0	0	0	0	100	0	40	20	0	20	0	0	20	0	5000	50.00
57	100	5	59.3	0	0	0	100	0	0	0	30	30	0	30	0	0	10	0	5930	59.30
58	100	5	51.3	0	20	0	80	0	0	0	35	20	0	20	0	5	20	0	5130	51.30
59	100	5	38.7	0	60	0	40	0	0	0	30	30	0	30	0	0	10	0	3870	38.70
60	100	5	43.0	0	80	0	20	0	0	0	15	35	10	30	0	0	10	0	4300	43.00
1	100	5	16.0	10	30	0	20	40	0	0	0	40	0	40	0	0	20	0	1600	16.00
2	100	5	15.0	20	30	0	20	30	0	0	20	40	0	40	0	0	0	0	1500	15.00
3	100	5	15.3	0	60	0	20	20	0	0	40	20	0	20	0	0	20	0	1530	15.30
4	50	5	24.0	0	0	0	0	100	0	0	25	30	0	40	0	0	5	0	1200	12.00
61	100	5	32.7	0	100	0	0	0	0	0	30	20	0	30	0	10	10	0	3270	32.70
62	100	5	42.7	0	0	0	100	0	0	0	20	30	0	30	0	10	10	0	4270	42.70
63	100	5	35.3	0	0	0	100	0	0	0	30	30	0	20	0	0	10	0	3530	35.30
64	100	5	36.0	0	80	0	20	0	0	0	15	30	0	40	0	5	10	0	3600	36.00
65	100	5	40.7	0	20	0	0	0	80	0	20	30	0	30	0	0	20	0	4070	40.70
66	100	5	41.0	0	20	0	0	0	80	0	20	30	0	30	0	0	20	0	4100	41.00
67	100	5	37.7	0	0	0	100	0	0	0	30	30	0	30	0	0	10	0	3770	37.70
68	100	5	46.7	0	0	0	40	0	60	0	50	20	0	30	0	0	0	0	4670	46.70
69	100	5	55.3	0	0	0	100	0	0	0	30	30	0	30	0	0	10	0	5530	55.30
70	100	5	42.7	0	0	0	0	0	100	0	40	30	0	30	0	0	0	0	4270	42.70
71	100	5	28.7	0	0	0	0	0	100	0	30	30	0	30	10	0	0	0	2870	28.70
Sub-total																			443792	
Small tributary flowing into the main river.																				
1	100	1	2.4	0	0	0	100	0	0	5	50	35	0	10	0	0	0	0	243	2.43
2	30	1	3.6	0	0	0	100	0	0	80	10	5	0	5	0	0	0	0	109	1.09
Sub-total																			352	3.52
Bunker Hill Brook																				
1	100	4	44.7	0	0	0	40	0	60	0	20	30	0	30	0	0	20	0	4470	44.70
2	100	4	31.3	100	0	0	0	0	0	0	0	0	0	10	0	70	20	0	3130	31.30
3	100	4	27.3	60	0	0	0	0	40	30	0	20	0	30	0	20	0	0	2730	27.30
4	100	4	30.0	0	0	0	0	0	100	0	20	30	0	30	10	0	10	0	3000	30.00
5	100	4	26.0	0	0	0	20	0	80	0	25	30	0	30	0	0	15	0	2600	26.00
6	100	4	26.0	80	0	0	20	0	0	0	20	0	30	10	0	10	30	0	2600	26.00
7	100	4	28.0	0	0	0	0	0	100	0	30	30	0	30	0	0	10	0	2800	28.00
8	100	4	34.0	80	0	0	20	0	0	0	10	30	0	30	10	10	10	0	3400	34.00
9	100	4	26.0	0	40	0	40	0	20	20	20	30	0	30	0	0	0	0	2600	26.00
10	100	4	36.7	0	0	0	80	0	20	0	50	20	0	30	0	0	0	0	3670	36.70
11	100	4	32.0	10	30	0	30	10	20	30	50	10	0	10	0	0	0	0	3200	32.00
12	100	4	28.7	0	40	0	40	10	10	10	50	0	0	20	0	10	10	0	2870	28.70
13	100	4	26.7	0	80	0	0	0	20	10	40	30	0	20	0	0	0	0	2670	26.70
14	100	4	27.3	0	30	0	30	0	40	10	50	20	0	20	0	0	0	0	2730	27.30
15	100	4	21.3	0	40	0	20	0	40	5	30	20	0	30	0	5	10	0	2130	21.30
16	100	4	26.0	0	90	0	0	0	10	0	60	20	0	10	0	0	10	0	2600	26.00
17	100	4	22.0	0	40	0	0	0	60	80	7	1	0	2	0	0	0	0	2200	22.00
18	100	4	28.0	0	100	0	0	0	0	5	0	30	0	30	0	15	20	0	2800	28.00
19	100	4	31.3	0	70	0	30	0	0	0	30	30	0	30	0	0	10	0	3130	31.30
20	100	4	32.7	0	0	0	100	0	0	0	40	30	0	30	0	0	0	0	3270	32.70
21	100	4	25.3	0	80	0	0	0	20	40	35	5	0	20	0	0	0	0	2530	25.30
Sub-total																			61130	611.30

TOTAL: Bottom Area: 505273.9(m2)
Rearing Units: 5052.7(100m2)

Appendix 5. Stream survey results summary.

Stream Name	Stream Order	Total Stream Length Measured (km)	Average Width (m)	Stream Area (m2)	Rearing Units (100sq.m)
Mainstream					
LaPoile River	5	10.0	44.0	443792	4438
Tributaries					
Small Tributary	1	1.3	3.0	352	4
Bunker Hill Brook	4	2.1	29.6	61130	611